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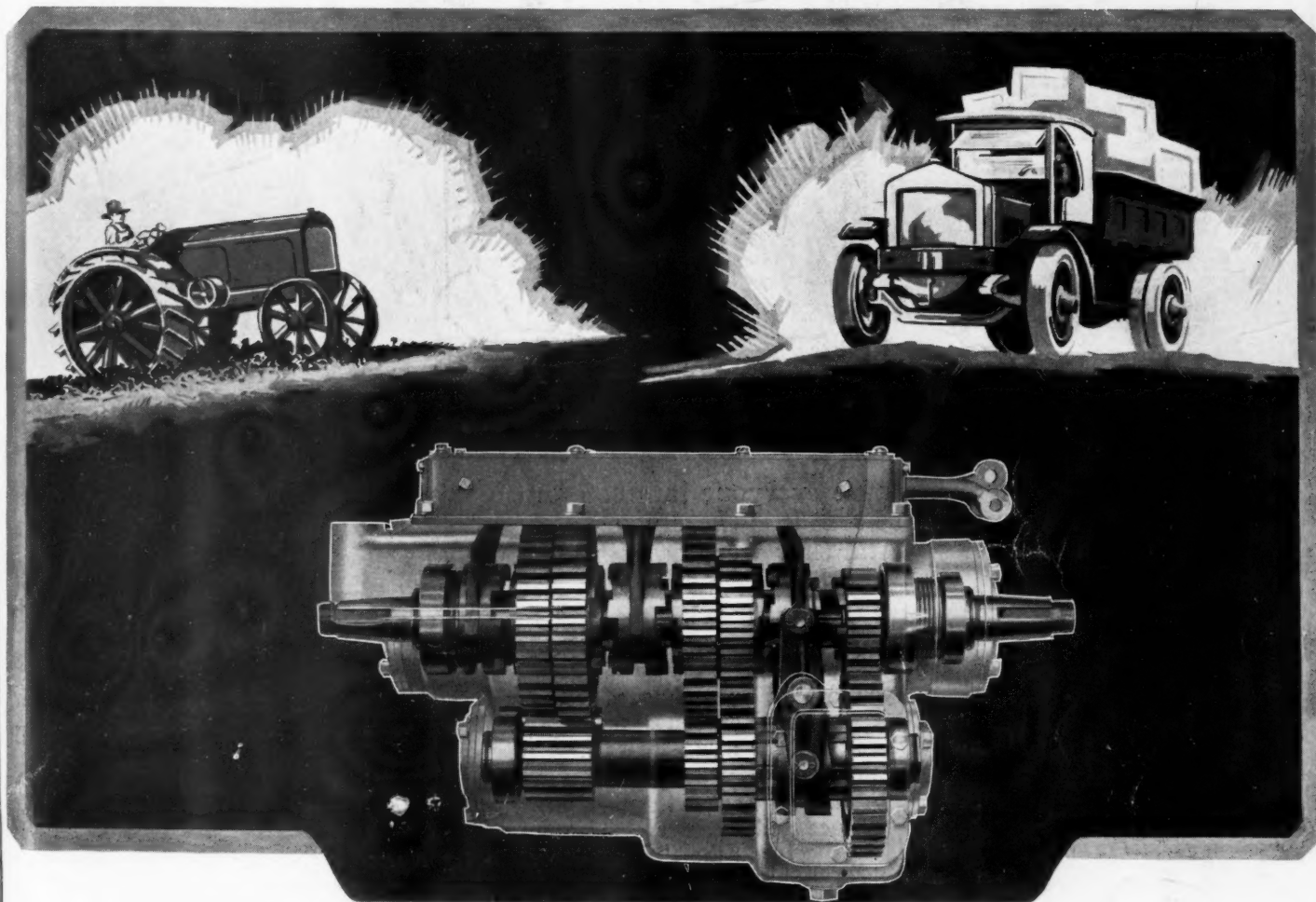
AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

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Number 5

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AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

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Merchandising Interests Strong at Chicago Show

Special exhibits attract most attention of the visitors. General plan, like that of the New York show, is somber. Stripped chassis are points of interest in early days but lecturers are lacking. Separate truck show starts with parade but fine display in International Amphitheatre does not attract crowds.

CHICAGO, Jan. 26.

THE Chicago Show opened yesterday in the Coliseum, Annex and Armory. Attendance was not as good as at previous show openings, due no doubt to the influenza scare and to the snow storm prevailing during the greater part of the day. There are eighty-four passenger car exhibitors and 163 accessory exhibitors. The National Truck Show is being held simultaneously at the International Amphitheatre. There are sixty-five makes of trucks exhibited and sixty-seven truck accessories.

During the week there will be an unusual number of meetings of dealers and factory sales forces. The manufacturers are regarding the Chicago show as they did the New York show—an opportunity to rebuild the sales organizations that were allowed to disintegrate during the war. This is practically the first opportunity the factory men have had of meeting dealers in considerable numbers since the industry has again gained full speed, and the forehanded salesmen are looking forward to the time when the demand will not so greatly exceed the output as it does to-day. The factory men are greatly interested in the messages brought by the dealers as to the feeling in their districts.

The car exhibitions are largely of stock models although there are a few special exhibits which stand out prominently. Conspicuous among these is the special Packard touring car with victoria top, tonneau cowl and disk wheels, colored in maroon. In place of running boards there are steps and the car above the frame is special throughout, although mounted on a standard chassis. This car, priced at \$10,000, was sold before it reached the floor of the show room.

Few Special Exhibits

Some of the other special exhibits which are attracting attention are the Cole, which is exhibiting a green touring car with a nickel hood; the Velie, which has a Cubist foursome upholstered in Spanish leather; the Olds, with a robin's egg blue model with blue leather upholstery; and the Franklin, with a 5-passenger car having special step running boards, tonneau, windshield, etc., fitted with velour slip covers in blue.

These special exhibits are the exception, however, and the exhibition does not stand out as remarkable from a merchandising angle. There seems to be too many stock exhibits and one is forced to the conclu-

sion that the efforts of the dealers last year to make the show a real trade stimulant is lacking on this occasion.

Closed bodies predominate, as they did at New York. The preference runs to sedans with coupés second and the chauffeur-driven types in the minority. In addition to the closed cars there are some samples of the California type of top which are exciting considerable comment. This top has a permanent roof and takes the place of the cumbersome winter top previously provided as additional equipment for touring cars. The California top is an all-year type, providing a permanent roof of about the same shape and general outline as the summer top on the touring car. The rear or gypsy section is permanently closed in with a sliding glass to form the central side section. The first section to either side of the driver's seat is closed by pulling down a celluloid curtain, thus giving a completely closed-in transparent sided body. Weather stripping is utilized to seal the sides against dust and moisture.

Stripped Chassis Attract

The number of stripped chassis is about as large as usual, and, contrary to common belief, the stripped chassis excites as much attention and study on the part of the average show visitor as ever. Lecturers on these stripped chassis were not as common as in previous years, but the one expounding the Stanley steam car attracted a throng of visitors.

One of the most effective and at the same time inexpensive methods of "toning up" a stock car for exhibition purposes is by the use of slip covers. The velour slip covers used on the Franklin exhibition cost \$190. They change the entire appearance of the car, making it look like a custom built body. The use of additional lights, such as corner dome lamps and step and tonneau lamps, also brings the car out in a striking manner and makes it a far better exhibition proposition than the stock model.

Now a year goes by without an increased demand for individuality among the buyers of sport and closed cars. The touring car purchaser seems to be more content with stock color and equipment than are the buyers of other models, but it is noticeable that where a model has been particularly dressed up for the show, even at from \$300 to \$500 increase in price, these are snapped up by purchasers much more rapidly than the lower-priced stock models. A good example of this is the \$10,000 Packard touring car which, owing to its additional equipment, was priced at more than double the regular stock price. In spite of this the car was sold before it was even completed for the exhibition.

The Truck Show

The truck show, being held at the International Amphitheatre, is practically as far removed from the passenger car show as was the exhibition at New York. It is believed, however, that because of the more comfortable building and more vigorous publicity methods, the show will be more of a success. A truck parade was held Saturday with about 2000 trucks borrowed from numerous fleet owners in Chicago. The parade started from four different points

in four different sections and finally all came together in one long line which went out through the stockyards section and by the show building. One division with about 500 trucks went through the loop and, besides tying up traffic, gave the show a great deal of publicity.

The Amphitheatre is a mammoth auditorium with side rooms and a balcony, at the Union Stock Yards, about a half hour from the loop. There is an immense amount of floor space, the building is well lighted and decorated, the show as a show is a wonderful exposition, but judging by the early attendance, the public will not be present in very large numbers. And if the people don't visit the show the show will not be a success. What is the use of running an advertisement in a paper if the paper is not seen by the people? And this is what the truck show amounts to. It is a huge advertisement of the industry, designed to thrust the truck into the face of the business world and the general public, and if the public and the business man don't see the show the result is small indeed.

Of course, the show makes an excuse for a lot of newspaper publicity for the truck, but that could be secured at any time by any other excuse—which also might not be so expensive.

Good Vehicle Display

In this Chicago truck show is the same great array of trucks that was in the New York show. There are all kinds of bodies, many sizes of chassis, the same interesting pneumatic tire equipment, the same Highway Transport Conference, the same pretty decorations and music and everything that was done in an effort to make the New York truck show a success.

Pneumatic Tires

The outstanding feature of the truck show is the increasing use of pneumatic tires, substantially 50 per cent of all the trucks shown being mounted on pneumatics. The largest truck shown on pneumatic tires was a 5-ton Master, which carried 48 x 12 in. tires on the rear wheels and 48 x 8 in. on the front wheels, all of Goodyear make. These pneumatics are not regular equipment, but are offered at an extra cost of \$1010. There were several 3 and 3½ ton trucks fitted with 44 x 10 pneumatics.

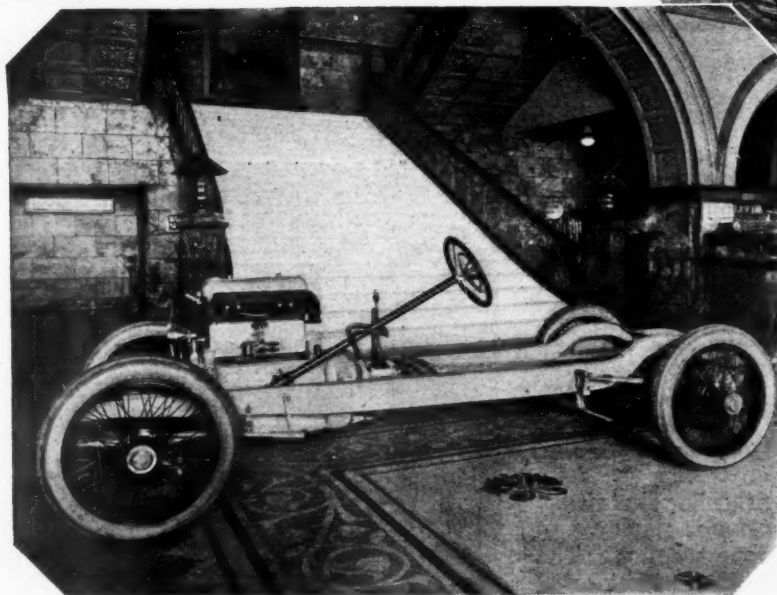
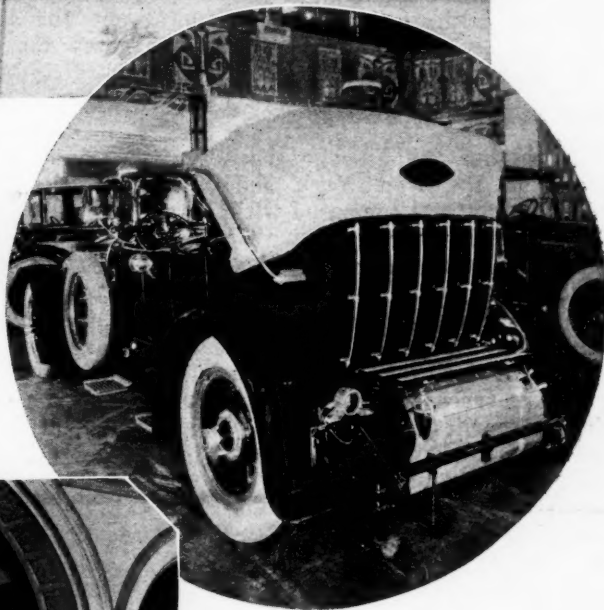
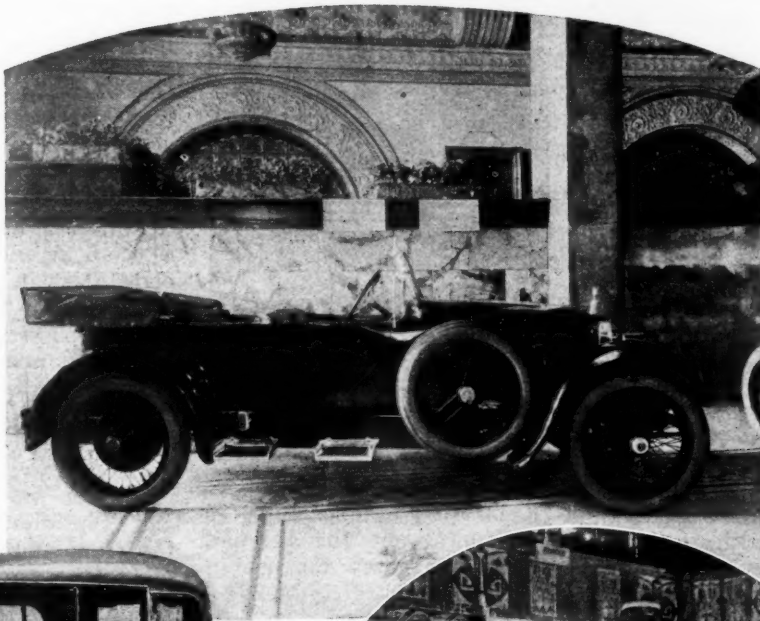
The first motor truck to be especially designed for the use of pneumatic tires is a 3-ton Packard which is fitted with the same engine that goes normally into the 5-ton Packard truck. Tests made by the Packard Co. showed that in order to be able to maintain the increased truck speed which the pneumatic tire makes possible, it is necessary to have more power than trucks have been provided for in the past.

There appears to be also a tendency to furnish a more complete equipment with motor trucks. This was well exemplified by two Jumbo models exhibited.

Among the items of regular equipment furnished with this truck may be mentioned the following: Radiator guard, radiator shutters operated from the dash, radiator shroud, electric lights, electric starter, electric horn, motor, dash oil gage, and ammeter. These trucks are provided with a closed driver's cab, consisting of a metal seat and a riser, with a wooden top, to deaden the noise, and with roll curtains to completely enclose the cab in winter. There is also a substantial two-part windshield.

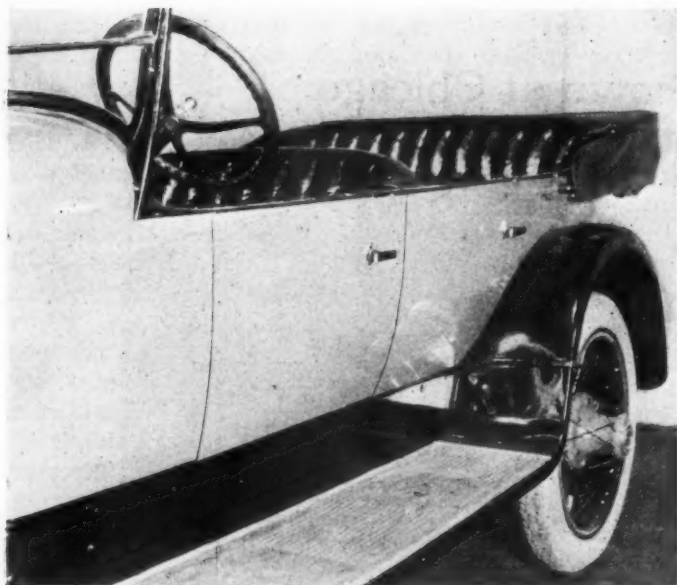
Attractive Models Shown at Chicago

The car shown at the right is the H. C. S., Harry Stutz's new car, which in Chicago, as in New York, was exhibited in a hotel lobby. Below is shown the Leach-Biltwell, a California product, which is featured as a stock production with a "custom-built" appearance



Car above is the Packard Special, priced at \$10,000, which attracted much attention at the show

The H. C. S. chassis. It will be seen that this is a very clean design



New Lexington touring body, showing arrangement of the doors

The four-speed gearset on the 3½-ton Jumbo model is provided with three power take-offs—one for a hoist, one for a winch, and one for a tire pump for use in case pneumatic tires are fitted.

New Vehicles

Altogether the Chicago truck show was not quite as large as the New York show, there being only 59 truck exhibits as compared with 70 at the New York, and 244 trucks as compared with 238 at New York. Five makes of trucks not seen at New York were exhibited at Chicago, including the Hall, Hendrickson, Standard, Napoleon and Victor. In addition to the trucks, there were exhibited six makes of trailers, namely, the Automotive, Fruehauf, Highway, Lee, Trailmobile and Warner, and five makes of truck bodies, viz. the Eberhard, the Lee Loader, the Metropolitan, the Obenchain-Boyer, and Martin-Parry.

Because of railroad delays some of the cars were not in place when the show opened to-day. For instance, the entire Overland space was empty, the exhibits being reported in the railroad yards in Chicago.

Leach-Biltwell 6

The new Leach-Biltwell 6, exhibited for the first time, is manufactured by the Leach-Biltwell Co. of Los Angeles. This is said to be the first car ever turned out in the Golden State on a quantity production basis. It is an assembled job, comprising such units as the Continental Model 9N engine, Rayfield carburetor, Delco starting, lighting and ignition, Borg & Beck dry plate clutch, Brown-Lipe transmission and Timken front and rear axles.

Fuel is taken from a 20 gal. tank hung at the rear of the frame and fed to the carburetor by the Stewart vacuum system. Cooling water is circulated by means of a centrifugal pump through a radiator with a 4 in. core. The radiator is of special design harmonizing with the body outline. The final drive is through a propeller shaft with two universal joints, and a Hotchkiss drive is employed to take care of the driving thrust and torque reaction. The rear axle is of the semi-floating type, with spiral bevel driving gears. Brakes are exceptionally large in dimensions, and equalizers are employed to divide the operating effort between the brakes on opposite sides.

The frame is one of the heaviest ever used in passenger car construction, the channel side members measuring 8 in.

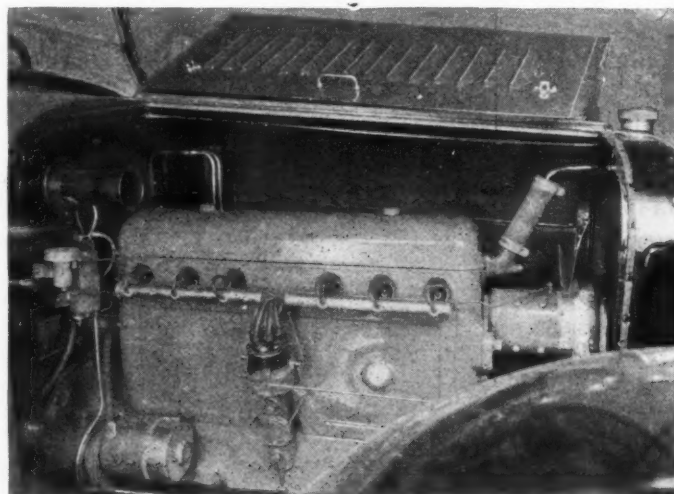
in depth. An irreversible type of steering gear is fitted. The steering wheel is a Liberty and can be dropped to give the driver easy access to the seat. It is fitted with a special theft-proof feature, removal of the Yale key freeing wheels and making guiding of the car impossible.

The body is specially built in the Biltwell shops and is of the streamline type. Steps take the place of running boards and a step light is mounted under each. These lights are automatically lit up by opening the door. The fenders are hand made and are so designed as to encircle the wheels as nearly as possible and still give sufficient road clearance. The windshield, which is in the form of a single piece of plate glass, conforms to the shape of the cowl and can be tilted for ventilation. A special ventilator is set into the top of the cowl and is operated by a knob on the dash. The frame supporting the windshield is bolted to the body and extends a few inches to the rear, carrying plate glass in the side extensions.

Two body styles are being offered, a five-passenger and a seven-passenger type, both exceptionally roomy in the driving compartment as well as the passenger compartment. Both bodies are equipped with a distinctive design on top with sliding curtains. These tops are stationary and carry glass panels at the rear, extending forward to the rear of each rear door. A nickel-plated joist, concealed in the top when not in use, releases by touching a button and drops down to a special fastening on the body between the front and rear doors. To completely close the car, a glass panel paralleling the rear enclosure slides forward to meet the joist, thus effectively enclosing the rear compartment. There is a curtain concealed in the forward part of the top operating on rollers. When this curtain is pulled down its edges are held in place by grooves in the joist and the windshield posts. These curtains can be held in any position.

Items of equipment include a Crosby direction signal secured to the left rear fender; dash lights on both sides under the hood by means of which to make engine adjustments at night; electric cigar lighter; Waltham speedometer and clock; Gasograph gasoline gage on the dash; luggage compartments in the quarter-sawn oak dash and panels in the back of the front seats, fitted with locks; arm rests on both sides of the rear seats, front and rear bumpers, trunk and luggage carrier, Duplex lamps.

Either wire or disc wheels are supplied, five to a car, the extra wheel being carried on the left side between the fender and the left front door. Tire equipment is Silver-town cord, 32 x 4½ in.



Nash engine. Plugs have been changed to this side of engine, away from exhaust heat

Heavy Crankshaft Features New Marmon Engine

This shaft, $2\frac{3}{4}$ in. diameter, mounted on three bearings, is said to eliminate periodic vibration at any speed. Piston is of aluminum and iron construction. Cylinders are fastened to crankcase in same manner as head is attached to cylinder block, studs extending through block to head.

By J. Edward Schipper

THE Marmon 34 appears for 1920 with a variety of changes in design, most notable among which is the substitution of cast iron for aluminum in the cylinders. This eliminates the sleeve construction, but adds no appreciable weight, the cylinders being cast in blocks of threes. A two-piece aluminum and iron piston and a $2\frac{3}{4}$ -in. crankshaft are other outstanding features.

The new engine construction saves 3 in. under the hood, but since the wheelbase remains at 136 in., the amount saved is distributed in the body, 1 in. being given to the front compartment, and 2 in. to the tonneau. Another noteworthy feature is the adoption of the Delco system for starting, lighting and ignition, with the elimination of the magneto.

The present series of Marmon cars was inaugurated in 1916, at which time the overhead valve, aluminum engine mounted in a Z-bar frame, was a notable departure from conventional practice. Previous to 1920 modifications have been only of a minor nature, but experience gained in manufacturing the Liberty engine has had much to do with the alterations made this year. Three of the important engine castings, including the crankcase assembly, the cylinder head cover and the timing gear cover plate, water pump body and flywheel housing, are of aluminum. The crankcase casting is particularly noteworthy, being of box-like structure, with internal ribbing and long, flat vertical side walls, providing exceptional stiffness and a rigid support for the bearings.

Cylinders in Blocks

No change has been made in the cylinder dimensions, which remain $3\frac{3}{4} \times 5\frac{1}{8}$ in. Block tests made without exhaust manifold or pipe, and with a $1\frac{1}{2}$ in. Stromberg carbureter, Model H, with a standard $1\frac{1}{4}$ -in. air valve spring, show 82 hp. at 2400 r.p.m. The maximum torque, 222 lb.-ft., is developed at 1450 r.p.m.

The new cylinder castings, which are in blocks of three, have resulted in the use of a three-bearing crankshaft, thus saving 3 in. in length. One of the weight saving

features of this casting is the short water jacket, the bottom edge of which takes the place of the hold-down flange found on cylinders of conventional design. While the water space between adjacent cylinder walls is not eliminated, the cylinders are nevertheless placed very closely together.

The cylinders are fastened to the crankcase in the same manner as the cylinder head is attached to the conventional cylinder block, studs being fastened into the crankcase and extending up through the block to the cylinder head. Thus when the cylinder head is fastened in place, the whole engine is tied together on these long studs. Removal of the cylinder head permits removal also of the cylinder blocks, as they lift off the studs. The nuts holding the cylinder head and cylinders in place are on top of the engine.

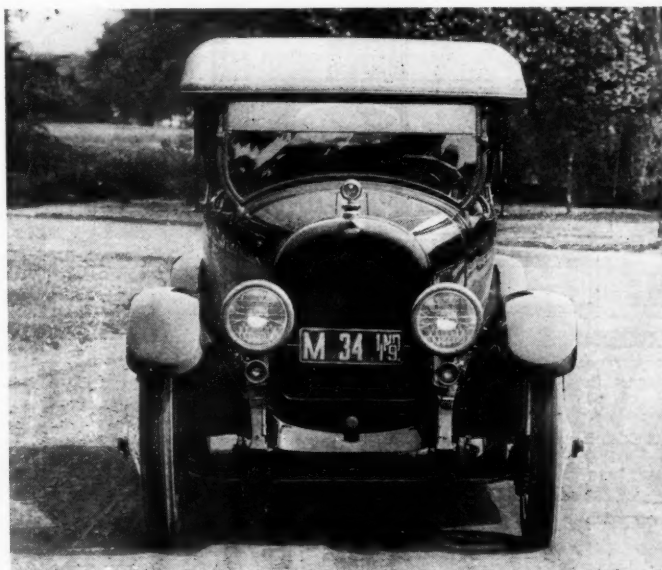
To eliminate periodic vibration at any speed, a three-bearing crankshaft of $2\frac{3}{4}$ -in. diameter with $2\frac{5}{8}$ -in. crank pins has been adopted. It is claimed by the Marmon engineers that the three-bearing type of crankshaft permits of perfect balance without the use of counter-weights, and the

webs between the crankpins are formed to put the shaft inherently in static and dynamic balance.

Shimless Bearings

Another feature of the Marmon main bearing, the manufacture of which has already been described in AUTOMOTIVE INDUSTRIES, is that it is shimless. These bearings are all $2\frac{3}{4}$ in. in diameter and $2\frac{1}{4}$, $2\frac{1}{2}$, $3\frac{3}{4}$ in. in length for front, center and rear respectively.

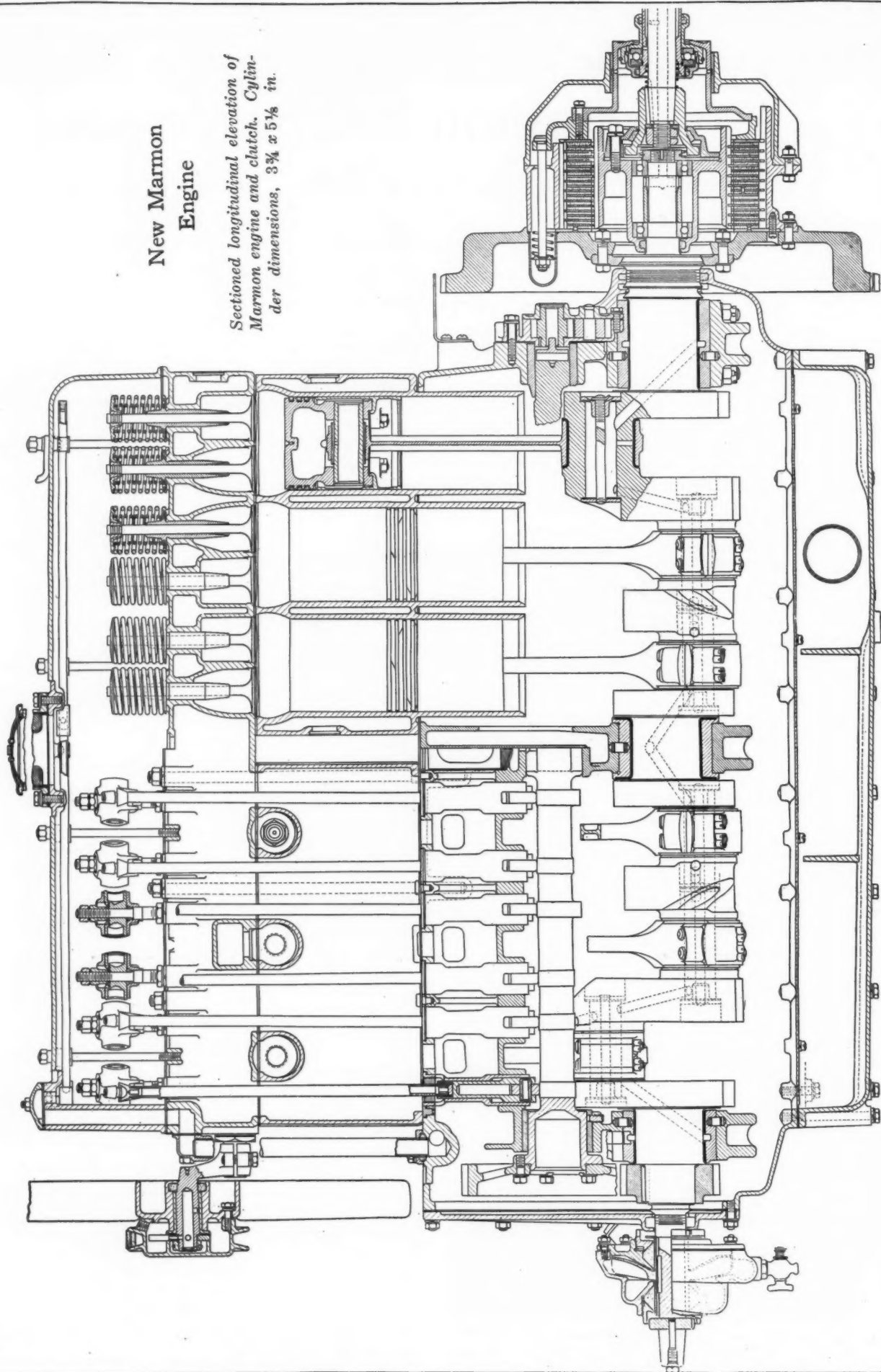
This provides a total projected area of 23.375 sq. in., which is exceptional for an engine of $3\frac{3}{4}$ in. bore. The shimless bearing is claimed to be advantageous because it presents an unbroken surface to the crankshaft journal. The notches necessitated by shims are claimed to wipe the oil from the bearings. With the continuous unbroken surface, it is claimed that the integrity of the oil film is maintained, wear being practically eliminated, and a floating bearing maintained.



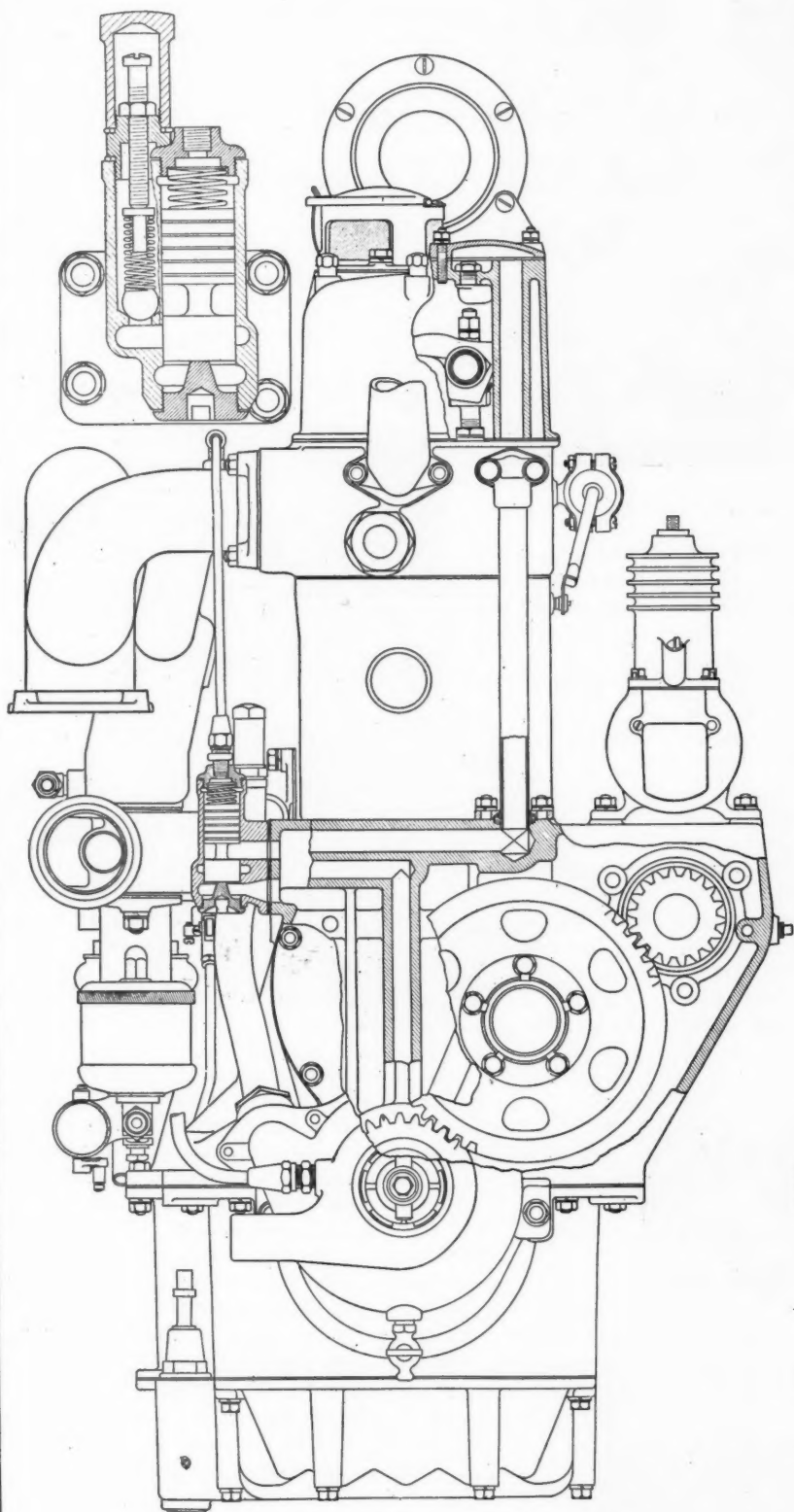
Front view of the new Marmon

New Marmon Engine

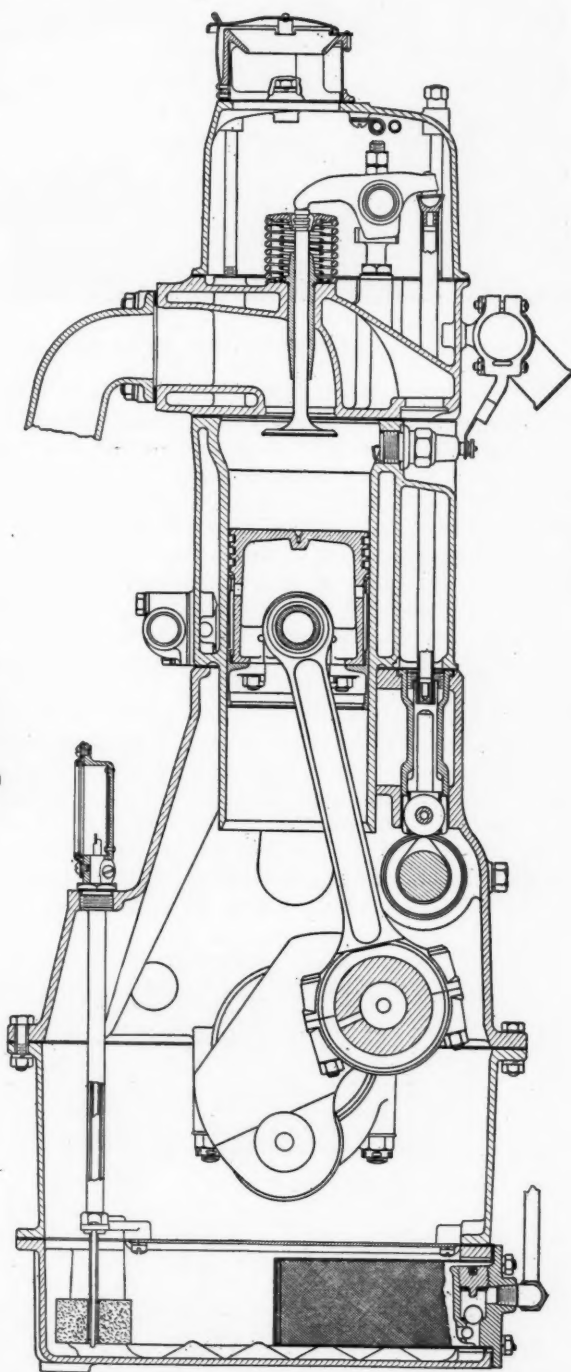
Sectioned longitudinal elevation of
Marmon engine and clutch. Cylin-
der dimensions, $3\frac{3}{4} \times 5\frac{1}{4}$ in.



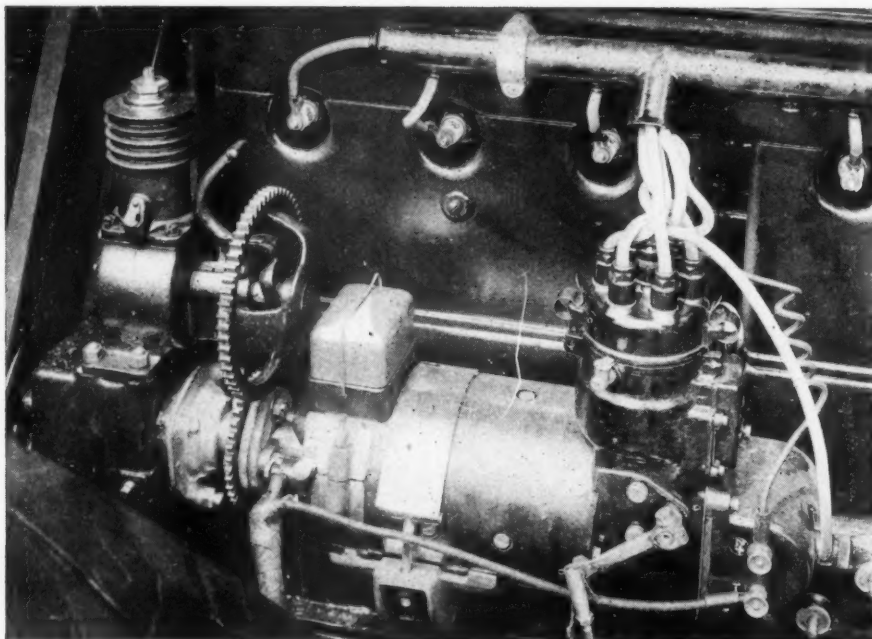
New Marmon Engine



Front elevation, showing details of oiling system.



Cross section through crankcase, cylinder and head



Generator, air pump and ignition unit

The shimless bearings are $\frac{1}{2}$ in. thick, to give them the stiffness necessary to maintain their cylindricity. The bearings are backed by cast-iron, which has been chosen because it has the same coefficient of expansion as the crankshaft and hence, does not tend to expand or contract at a different rate, which Marmon engineers have found is a characteristic of bronze and aluminum. This tendency on the part of aluminum and bronze bearings is claimed to account for a great part of the difficulty in starting in cold weather, on account of binding.

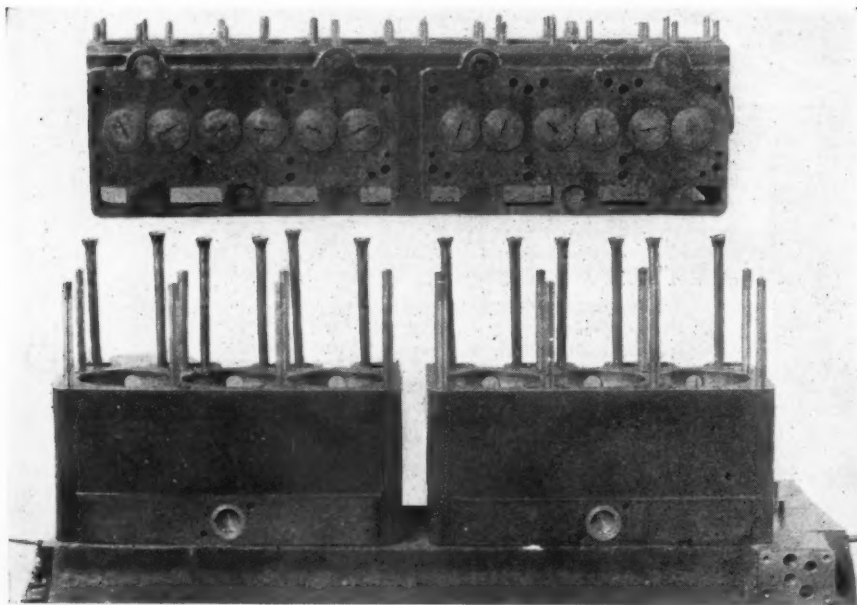
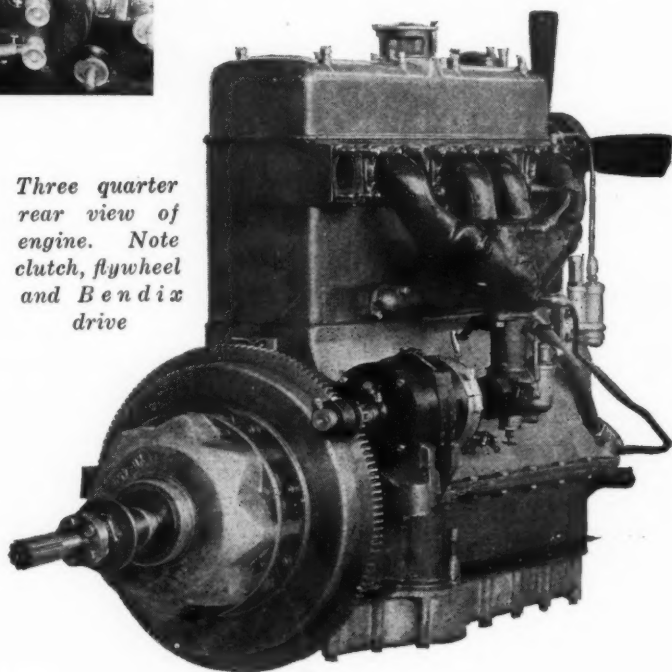
Each of the main bearing bushings is provided with a facing of anti-friction metal $\frac{1}{16}$ in. thick. On the center bearing, this facing extends over the ends of the bushing and carries the end thrust. The anti-friction metal is die-cast into the cast-iron bushing. The advantage claimed for this method of construction is the added stiffness of the iron bushing which helps it hold its shape more closely and the more effective contact with the upper half of the crankcase and with the bearing cap which holds it in place. It is claimed that the conduction of heat from

the bushing to the case is better, and consequently greater life will be obtainable. The main bearings are held in place by removable caps which are attached to the upper half of the crankcase by $\frac{1}{2}$ in. studs, two in the front and center bearings, and four in the rear bearings. The bearing caps are aluminum, with two ribs for stiffness and cooling. The bushings are prevented from rotating by means of dowel pins in the crankcase.

Rods Machined All Over

To guard against errors in balance, due to carrying connecting rod weights, a strict interchangeability is maintained on the rods. The rod is machined all over, not only for the purpose of being able to

Three quarter rear view of engine. Note clutch, flywheel and Bendix drive

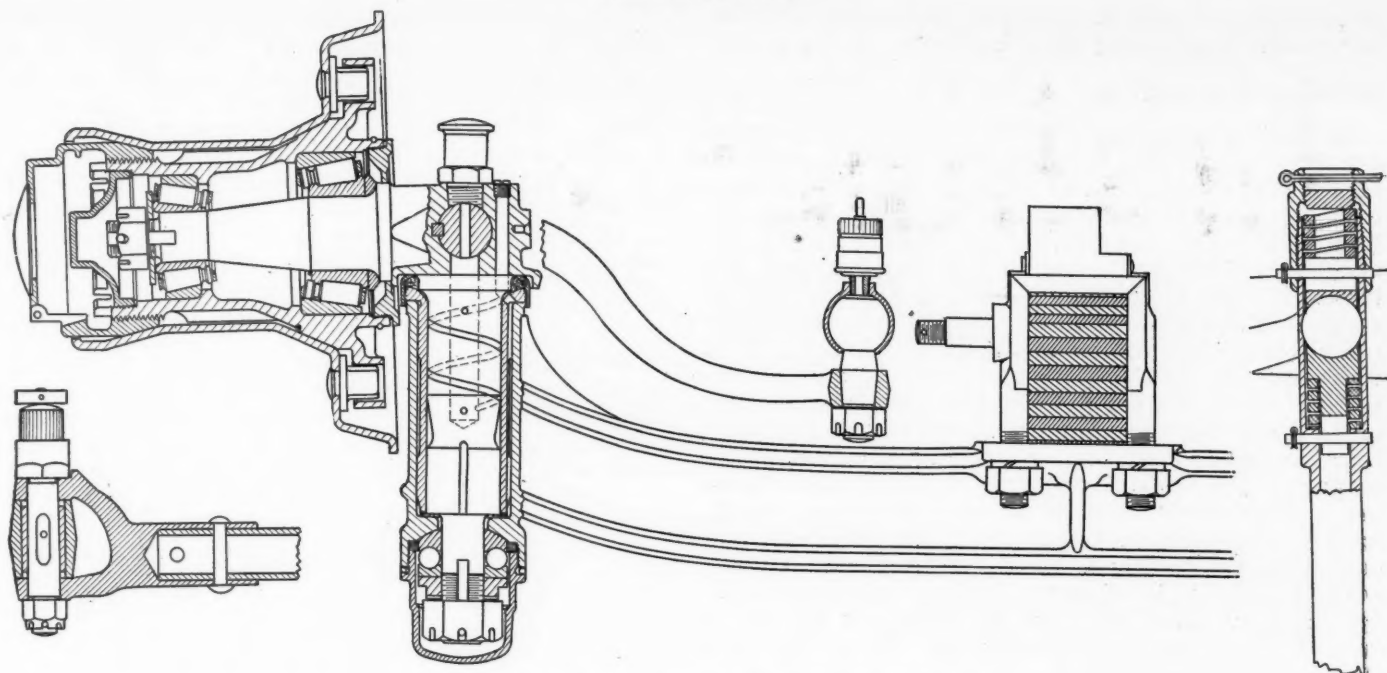


Cylinder head removed, showing "through" bolts

hold it to close limits, but also to obtain a minimum weight. The rough forgings for the connecting rods weigh $8\frac{3}{4}$ lb. The finished rod, including the four connecting rod bolts and nuts, weighs 3 lb. and 14 oz. The inside of the connecting rod big end is turned to insure a perfect seat for the crank pin bushing, and the bushing is die-cast directly in the end of the connecting rod. This is claimed to provide a more perfect contact of the bushing and rod and, for this reason, to conduct the heat away from the bearing more rapidly.

The Camshaft

In order to maintain the rigidity of the valve drive, a $1\frac{3}{8}$ in. camshaft is employed, with the cams forged integrally. The forward end of the camshaft is enlarged to form the front bearing, $2\frac{3}{8}$ in. in diameter and $1\frac{13}{16}$ in. long. Two flanges are formed at the center of the shaft on either side of the middle bearing to take the end thrust on the shaft, and



New front axle design and steering linkage details

at the rear end the shaft is extended beyond the cams to form the rear bearing. The center and rear bearings are each $1\frac{3}{8}$ in. in diameter and $1\frac{7}{8}$ and $1\frac{1}{2}$ in. long respectively. The front end of the camshaft is enlarged to form a $3\frac{1}{2}$ in. diameter flange, to which the camshaft and timing gear is secured with $5/16$ in. cap screws. For weight reduction, the front end of the camshaft is drilled out. This reduces the weight of the shaft by 4 lb. Constant acceleration cams are used in an effort to secure quick valve opening with noiseless closing.

Roller followers are used, the tappets being mounted and guided by die-cast tappet guides pressed into the top of the upper half of the crankcase. To keep the axis of the tappet roller and the axis of the camshaft parallel, provision has been made to hold the tappet guides in proper position in the crankcase with button headed dowel pins. These pins are placed between each pair of dowel guides and fit into semi-circular shaped notches cut in the flange at the top of the guide. This flange fits into a counterbore in the top of the crankcase, so that the top of the valve guide comes flush with the top face of the crankcase. The flange prevents the guide from being pushed down too far into the crankcase, and the cylinder block prevents the guide from working upward, while the dowel eliminates any tendency of the guide to turn. To remove the tappets, it is necessary to pull them upward after the cylinders are removed. A 1-in. by 2-thread tap is run into the top of the valve guides to permit a puller to be attached whenever it is necessary to remove valve guides.

The whole assembly of tappet, roller and roller pin, weighs 5.8 oz. The tappet has two outside diameters, $5/8$ in. where it fits the guide and $15/16$ in. where it carries the roller followers.

Valves in Cylinder Head

All of the valves are carried in the detachable cylinder head. The valves are directly over the center line of the crankshaft so that it is possible to use interchangeable valves, rocker arms, push rods and valve tappets. Although the cylinder blocks are cast in groups of three, the head is a single casting, which serves to tie the cylinder blocks together, and also eliminates any water connections

or manifolds between the two blocks. There are four intake and four exhaust ports in the right side of the cylinder head, to which the intake and exhaust manifolds are bolted. Carrying the two manifolds on the same side of the engine permits the use of a pre-heating system without complicating manifolds and extra hot air pipes.

The spark plugs are located in the top of the cylinder, instead of in the head, so that it is not necessary to disconnect the ignition wires when removing the head. On the top of the cylinder head are mounted the rocker arm supporting studs. These do not have to be disturbed when removing the head from the cylinder. To take care of the high speed characteristics of the engine, a particularly light weight valve operating mechanism is utilized. The weights of the moving parts are as follows: Push rod with button, 4.75 oz.; valve alone, 5.5 oz.; rocker arm and button, 6.25 oz.; tappet, roller and pin, 5.8 oz., and valve spring, retaining washer and key, 1.75 oz., making a total of 24 oz. for each valve system. The valve timing is as follows: Inlet opens 19 deg. late and closes 35 deg. late; exhaust opens 45 deg. early and closes 12 deg. late.

The intake and exhaust valves are interchangeable. Both are 2 in. in diameter, or more than half the cylinder bore. The valve stems are $3/8$ in. diameter and just over 5 in. in length. The intake and exhaust valves both have a lift of $3/8$ in. Both valves are equipped with dual springs.

The valve mechanism is entirely enclosed. There is an extra wall on the camshaft side of the crankcase, cylinder casting and cylinder head, which encloses the valve push rods. The overhead mechanism is enclosed within an aluminum cover and the breather of the engine is mounted on top of this cover so that all vapor or spray will readily reach the upper valve mechanism. This is also the point at which fresh oil is introduced into the engine. The valve mechanism is so arranged that adjustment for clearance can be made while the engine is running. The valve springs are light, the internal or small spring having a compression pressure of about 45 lbs., and the large external spring 65 lbs. when in place.

In machining the cylinder head, the combustion chamber is completely formed. The portion of the combustion chamber above the cylinder bore has a spherical shaped counterbore to give clearance for the valves and assist in

distribution. Completely machining the combustion chamber results in equalizing the compression pressure.

A Composite Piston

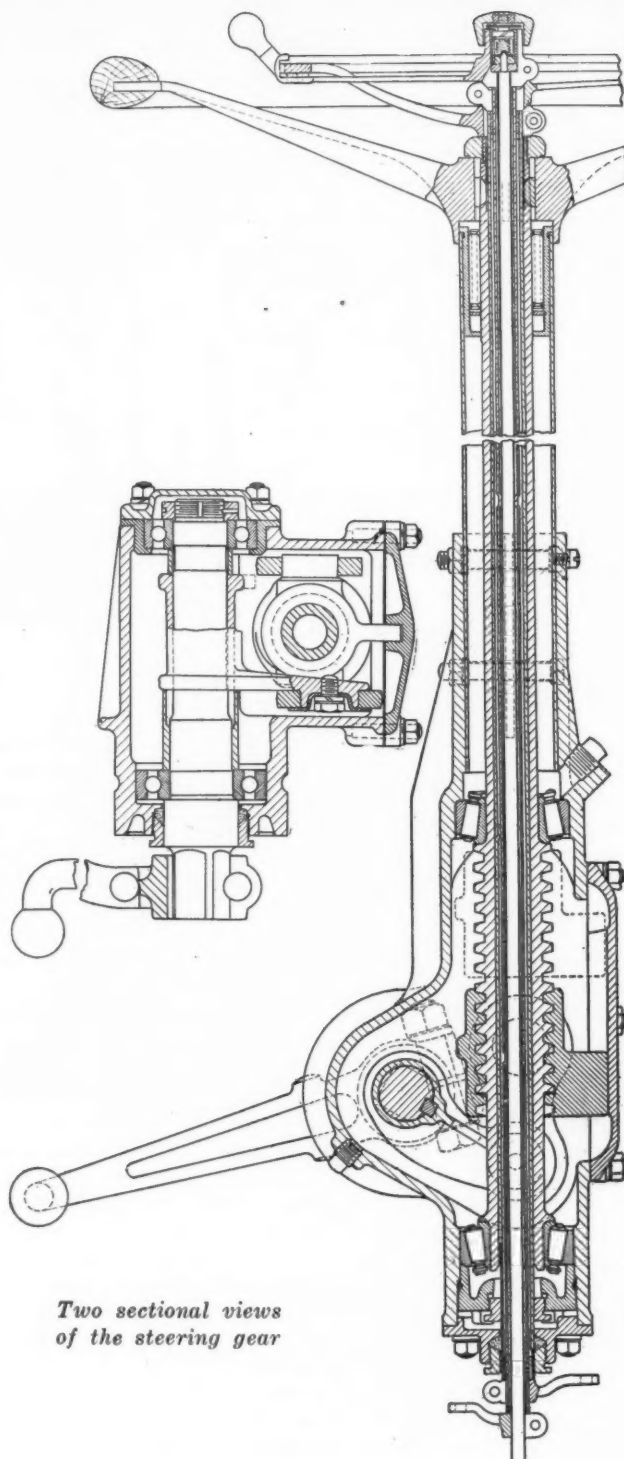
An interesting feature is the piston. The requirements are light weight, good compression and absence of smoking. The piston designed by Marmon includes all of these requirements and is of aluminum and iron, a composite type. The use of aluminum for the upper or hottest portion insures good conduction of heat from the head, and the use of iron for the skirt is designed to accomplish the sealing. The aluminum casting carries the piston rings and piston pin bearings, as well as the four 5/16 in. studs, which hold the two portions of the piston assembly together. The studs are screwed into the aluminum part of the piston and prevented from turning after they have been inserted by small brass rivets that pass through the casting wall in the stud. The top of the aluminum casting is provided with 3/16 in. piston ring grooves, equally spaced. The piston pin bosses are located near the bottom portion of the casting and are perfectly plain, reamed holes, 13/16 in. in diameter, with a bearing surface 1 3/8 in. long. The bottom of the aluminum portion is finished off to provide a bearing seat for the cast-iron skirt which is attached to it.

The skirt portion is a plain, cast-iron cylinder, with a flange on the inside to bolt up against the bottom of the aluminum portion. Its only connection with the aluminum portion is at this bottom flange, so that the difference in the expansion rates does not have any effect on the efficiency of the piston. Between the top of the skirt and the bottom of the piston ring section of the aluminum portion of the piston there is a circumferential opening into which the oil from the cylinder walls is scraped during the down stroke. The oil scraped off in this manner is caught in the 1/16 in. annular space between the parts of the piston assembly and fed into the piston pin bushings in the aluminum casting by oil ducts, and to the bronze bushing in the upper end of the connecting rod by an oil hole in the hollow piston pin. The total overall length of the completely assembled piston is 4 11/16 in. Of this length, 3 1/2 in. are taken up by the cast-iron piston skirt.

Automatic Lubrication

Lubrication of the engine is by an automatic, full pressure system. The maximum oil pressure is attained when the engine is working hardest, or when the pressure or vacuum in the intake manifold is lowest. This is in accordance with Marmon practice for a number of years. This year, however, the regulator is no longer placed between the crankshaft and the oil pump, but is at the front end of the oil system, or at the opposite end from the pump, with the crankshaft between. All the oil delivered by the pump at any speed is delivered to the hollow crankshaft. This tends to cool the shaft and provides an excess of oil, the bearings being provided with lubricating oil in proportion to the size of the outlet openings in the by-pass valve. As the by-pass valve is closed, the pressure on the oil in the center of the crankshaft is increased and hence more oil is forced out through the bearings. In this respect, lubrication of the rubbing surfaces is exactly the same as in previous Marmon cars, but with the additional advantage of having a cooling effect on the crankshaft and main bearing.

The main and crank pin bearings are claimed to practically float in oil, because they are shimless and grooveless, hence the full oil pressure is applied to these bearings and the oil can only escape by working between the two rubbing surfaces. The center circumferential oil groove



Two sectional views
of the steering gear

has been made after extensive experimental work to carry out the floating bearing principle. It is claimed that over ten times the supply of oil passes through the crankshaft as compared with the conventional type, and hence larger passages must be provided, both in the bearing bushing oil groove, and in the crankshaft itself. The oil holes in the crankshaft are 3/8 in. in diameter and the grooves in the bearings are 1/4 in. wide and 5/16 in. deep. Only the front and rear main bearings are provided with these grooves. All the oil delivered by the oil pump is fed to the rear main bearing, bushing grooves and from it into the crankshaft. Consequently, it has to be large enough to take this volume of oil.

The timing gears are oiled by a stream which is directed

to impinge on the point of contact between the crankshaft and camshaft gears. The generator drive gear, which forms the third gear of the system, does not depend upon the oil supplied in this manner for its lubrication, this being taken care of by a separate feed line. The oil pump is a gear type located at the rear of the engine just back of the camshaft. It is driven by an Oldham coupling from the rear end of the shaft. The oil regulator is located on the forward, right corner of the crankcase, and all the oil passages through the regulator are cast integral with the case.

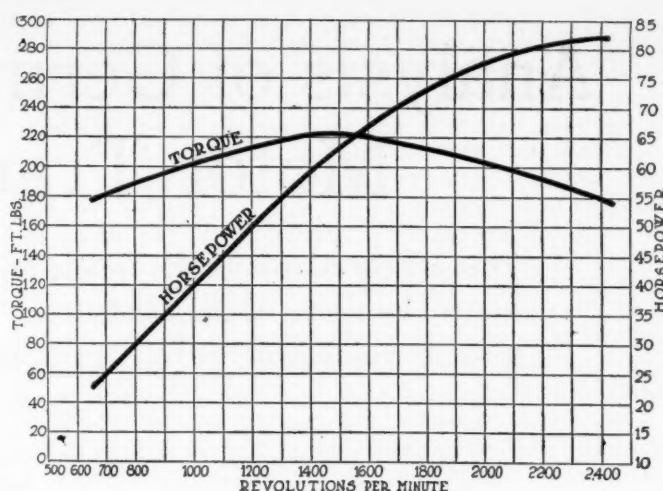
Disk Type Clutch

A new clutch has been fitted to give smoother and easier operation. It is a disk type with ten driving disks and nine driven disks. They are saw steel, Raybestos faced. The former cone clutch had a surface of 111.9 sq. in. The present multiple disk type has more than three times this area.

The transmission gearset is placed amidship on the forward end of the torque tube, just back of the cross-member in the center of the car. It is not fastened rigidly to the frame, but is freely held in suspension by a ball and socket joint which takes up the driving and braking thrust, as well as the torque. Three speeds forward and one reverse are provided.

The rear axle is a three-quarter floating type. The driving axle carries a taper which is drawn into the wheel hub. The rear axle housing is divided into three sections, two drawn steel end supports and a cast aluminum distance piece in the center. The central piece acts as the differential housing. The brake drums are pressed steel. The drive is through helical bevel gears. The torque tube is tapered from the rear to the forward end.

The deep frame chassis which has distinguished the Marmon car for the past three years is continued. This is a combination of channel and Z section, the running board forming the lower horizontal portion of the Z, and the top flange the upper. The vertical portion of the frame is 10 in. deep. The chassis is distinguished by the fact that it has only four grease cups, three of these being on the steering linkage and one on the steering gear. All of the spring shackle bolts, the brake shaft bearings, etc., are carried upon self-lubricating asbestos bushings. The rear springs are the compound cantilever, cross-suspen-



Horsepower and torque curves

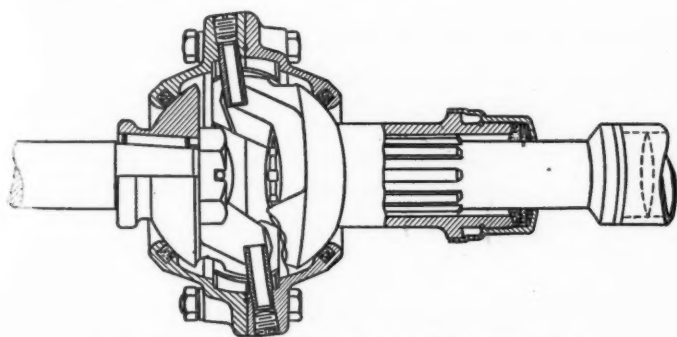
sion type used on the previous models. The left end of the upper spring is shackled to the frame, while the right end is attached rigidly with the usual eye bolts. The lower spring is secured to the rear wheel brake drum covers in the same manner, that is, the left end shackled and the right end rigid. The front springs are semi-elliptic.

The gasoline tank is carried in the cowl, giving a gravity feed to the carbureter. It is above and to the rear of the engine, the pipes from the tank to the carbureter being only 39 in. long. The tank has capacity of 18 gal. and has a magnetic gage on the cowl to indicate the amount of gasoline in the tank. The speedometer drive is through a flexible shaft from the pair of helical gears running in oil, mounted on the main drive shaft to the rear of the gearset up to the front seat.

Demountable wire wheels are furnished as standard equipment, but wood wheels will be supplied when wanted at an extra cost. One extra wire wheel without tire is supplied. Tire sizes on the touring and roadster are 32 by 4½ in., front and rear. On closed models, 33 by 5 in. oversize, front and rear. Prices on the Marmon car for the 1920 season are as follows: Seven-passenger, four-passenger and roadster, \$4650; coupé, \$5800; sedan, \$6250; limousine, \$6450, and town car, \$6450.

Test of Universal Joints

A SERIES of torsion tests upon AB universal joints manufactured by the Easton Machine Co. were recently made in the Laboratory for Testing Materials at the Massachusetts Institute of Technology.



A B universal joint in which tests were made

The specimens were centered in a torsion machine. In the first test the universal was connected up at one end to a 1½ in. S.A.E. standard taper with S.A.E. standard key, and at the other end to a 1¾ in. S.A.E. standard ten-

spline fitting. The joint failed under a twisting moment of 40,680-inch pounds, owing to the S.A.E. key shearing off. No damage was done to the ring, bushings or forks.

In the second test, made on the same joint fitted to new shafts, these being connected at one end by 27/16-in. keys and the other end by a 1¾-in. S.A.E. standard ten-spline fitting, the joint showed yielding under a twisting moment of 72,000-inch pounds, and failed under a twisting moment of 75,600-inch pounds. The shaft failed at the spline end by shearing at the neck. The keys started to shear slightly at the other end. No damage was done to the ring, bushings or forks.

In the third test the same ring was used as in Test No. 2, but fitted with two new forks and shafts. The shafts were solid at both ends and fitted with two 7/16-inch keys in each. The joint showed yielding under a twisting moment of 93,000-inch pounds, and failed under a twisting movement of 100,000-inch pounds. The shaft was badly twisted at one end and the keys sheared. At the other end the shaft was slightly twisted and keys sheared. No damage was done to ring or bushings. The keyways in the forks were slightly twisted. A scale drawing of the joint tested is shown herewith.

Analysis of German Trucks by the Motor Transport Corps

This article continues the report on the trucks surrendered to the A. E. F. under the terms of the armistice. The results of the investigations and tests are being made public as rapidly as they are completed for each truck.

By C. R. Hays*

Opel

Motor

Four cylinders, $3\frac{1}{2} \times 5\frac{1}{2}$ in. bore and stroke. Four point suspension by upper half of crankcase.

Cylinders

Cast en bloc, L head. Valves and exhaust ports on right hand side with carbureter intake on left hand side, running between the two inside cylinders, cylinders being heavily chamfered at the bottom and milled out on left hand side for clearance of connecting rods; the crankshaft is offset from the center of the motor, approximately $\frac{5}{16}$ in. The water jackets come down within 3 in. of the base of the cylinders. The combustion chambers are dome type. The water enters on the valve side of the front end of the motor, flows around the valve seats, guides and cylinders to the rear of the motor, and is discharged through a large cast iron manifold, running the full length of the cylinder block with the discharge end past the front end of the motor. The water enters at rear end of the manifold over the rear cylinder. There are exceptionally large water areas around the valve seats and guides, guides being pressed into the cylinders. The cylinders are approximately $\frac{3}{8}$ in. thick. Cylinder block cast for valve cover plates.

Flywheel

The flywheel is of cast iron, semi-finished and machined for cone clutch. Dia. is $15\frac{3}{4}$ in.; width, $3\frac{3}{8}$ in.; depth, $2\frac{5}{8}$ in. Depth of counterbore for cone clutch, $2\frac{3}{4}$ in.

Crankcase

Upper half of crankcase aluminum alloy casting, very heavily constructed and exceptionally heavily webbed. It is small and compact, and shows that a great deal of consideration has been given to the originality of crankcase construction. It is scraped, both inside and outside. The lower half of the case is of cast iron, with cast integral oil troughs, sump and false base. Located in the false base are large openings which are covered by

wire cloth, straining the oil before it re-enters the sump. The crankcase joints are lapped joints, having no gaskets.

Crankshaft and Bearings

Crankshaft is drop forging, machine finished all over. The short cheeks are $2\frac{3}{8}$ in. wide x 1 in. thick, except rear cheeks, which are $1\frac{1}{4}$ in. thick. Long cheeks are $2\frac{3}{8}$ in. wide x $1\frac{5}{32}$ in. thick. The fly wheel hub flange is forged integral with the crankshaft. There is a plain thrust bearing on the front end of the crankshaft. On the front and rear ends of the crankshaft are soft steel $\frac{1}{2}$ in. x $3\frac{1}{2}$ in. spiral gears, which are used as oil throw-off collars. The front gear is pressed on and the rear is split in halves, held together by two $\frac{1}{4}$ in. bolts. With the rotation of the shaft, the oil is thrown off the ends of the teeth toward the center of the crankcase.

Bearings are babbitt lined, bronze backed, and held down by four $\frac{1}{2}$ in. studs, and forged steel caps, with no shims. The bearings are in the upper half of the crankcase, the front being

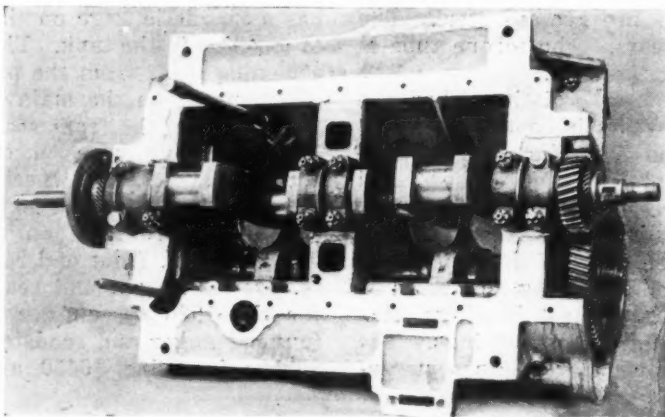
$3\frac{5}{16}$ in. x $2\frac{1}{4}$ in., the center $2\frac{1}{4}$ in. x $3\frac{1}{16}$ in. and the rear $2\frac{1}{4}$ in. x 4 in. Oil grooves in upper and lower halves of bearings.

Connecting Rods and Bearings

Connecting rods offset, drop forged, semi-finished, I beam with scuppers on caps. One oil hole over top half of bearing. Bearings are babbitt lined, bronze backed, $1\frac{7}{8}$ in. x $2\frac{1}{8}$ in.—held on by a two bolt cap with no shims. The piston pin bearings are bronze bushings, pressed into connecting rods with large holes in top of rods for lubrication.

Pistons and Pins

Pistons flat head type with four $\frac{1}{4}$ in. lapped joint, concentric, hammered, compression rings. Piston is $4\frac{1}{4}$ in. long with a V shaped oil groove below third ring, containing eight $\frac{3}{32}$ in. oil drain holes. The head of the piston is $\frac{3}{16}$ in. thick with inside webbing for stiffness and heat conductivity.



Crankshaft, timing gear and camshaft

*Mr. Hays is chief of the experimental section, Motor Transport Corps.

Piston pin is located 1 11/16 in. from top of the head to center of pin, the pin having 3/32 in. wall and 7/8 in. dia.; hardened and ground. Pin is pressed into the piston and a brass plug is used on each end of the piston to keep it from coming in contact with the cylinder walls. The piston skirts are 3/32 in. thick with 1/8 in. x 1/8 in. rib around bottom of the skirt, and three 1/16 in. oil grooves in the skirt, one being at the bottom and one each above and below the pin.

Timing Gears, Camshaft and Bearings

Timing gears are spiral type. Crankshaft gear is steel, not hardened, with thirty-one teeth, 3 31/32 in. dia. 1/4 in. depth, 7/32 in. at base of teeth, and 7/8 in. face, held on by straight key. Camshaft gear is of cast iron, held on by straight key and nut. The magneto and pump are driven by a cross shaft with the driving gear mounted in rear of the camshaft gear. This gear is spiral type and of hardened steel.

The camshaft is 1 1/16 in. in dia. hardened and ground, with cams forged integral with the shaft. The width of beams is 7/16 in. with lift of 9/32 in. and 1 3/8 in. dia.

Camshaft is supported by seven bearings, three of them plain bronze solid sleeve type bearings, and two annular ball bearings at each end of camshaft. One of the front ball bearings is held in place by the timing gear case. Forged onto the camshafts are three large bosses larger in dia. than the cams. This allows for the solid sleeve type bearing to slide over the cams. The bronze sleeves are pressed into the crankcase.

Valve Tappets, Guides and Valves

Valve tappets are the regular roller type, the plunger body being 3/4 in. in dia. soft steel with the typical adjusting tappet and lock nut, the plunger and adjusting tappet being hollow. In the head of the adjusting tappet is inserted a fibre washer. This type of construction is very light and makes a very unique type of valve tappet assembly. A compression spring is located around the valve tappet body, which makes tappet follow cam.

The valve tappet guides are 3/4 in. long and constructed out of cast iron with an oil channel and a by-pass hole provided in each side for lubrication into the tappet body.

Valves are the mushroom type, 1 7/8 in. in dia. 45° chamfered with 1/8 in. seat. Stem 5/16 in. dia. x 7 1/2 in. long and welded to the valve head. The valve spring cap is machined out of a solid piece of stock and is held in place by a 1/8 x 3/4 in. straight key, which goes through a broached hole in the valve stem. This valve has a very thick head and a heavy fillet. Valve caps are soft steel.

Governor

Governor fly ball type, located on the rear of the crankcase, on a cross shaft, the shaft being driven by a spiral gear on rear end of camshaft. The motion is taken by a forked bell crank arm. The fork end works on a sliding collar on the cross shaft. The other end is connected by a rod to the governor valve.

Oiling System

Combination force feed and splash system, oil being collected by scuppers on the end of the connecting rods from cast individual oil troughs in the lower half of the crankcase. This oil is kept at a level in these troughs by a two gear oil pump. The oil is carried in a cast sump base from which it flows to the pump. From the pump it passes through very fine perforated steel strainers, rising up to a level through a standpipe, then overflowing into the oil troughs. When the oil troughs are at the proper level, the oil is by-passed into another trough, where it drains through a perforated strainer

back into the sump and to the pump again. The pump is driven by a spiral gear and shaft, running directly off the camshaft. The force feed system is a plunger pump driven directly from an auxiliary cam on the camshaft, with one lead to the pressure gage on the dash, and the other lead going to a very large cast web, extending the full length of the upper half of the crankcase. Leading from this hollow web conduit are three drilled by-pass holes through a web leading from this conduit to each one of the crankshaft bearings. For convenience, there is located a rod on the side of the motor, which extends down through into the lower half of the crankcase, with numbers, indicating how much oil there is in the oil sump. There is also another very large drain for draining the oil out of the oil sump, which is located on top of the motor, extending through the upper half of the case to the oil sump, allowing the oil in the sump to be drained out without getting under the car to do so. The lubrication of the timing gears is by oil vapor from the crankcase.

Water System

Circulation by a 4 1/2 in. centrifugal bronze impeller pump, with a cast iron housing, having a 3/4 in. intake and discharge. The pump is driven by a cross shaft on the front end of the motor. The magneto is driven by the other end of this shaft. A spiral gear of soft steel in rear camshaft gear drives the cross shaft.

Ignition

Ignition system is a single system high tension, type ZU4 Bosch magneto. The magneto is anti-clockwise, the advance and retard by the conventional way by advancing the breaker box. For checking up the secondary rotor a celluloid window is located opposite contact No. 1 in the secondary distributor. Magneto is located on the right hand side of motor, and is driven by a gear from timing gear case.

Carbureter

Carbureter is a vertical Pallas, type IV, 1 5/8 in. with a 23 mm. venturi throat. The float is of cork and shellac. Idle adjustment is by a stationary well. The carbureter is cast aluminum, with no special features. The high speed is through a well running angularly through the venturi, the fuel being restricted by a compensator. The throttle valve is a butterfly type. Carbureter has a hot air attachment.

Fan

Fan 19 in. in dia. 4 blades, material steel sheet, riveted to a steel hub, having machined fan pulley. A cast iron bracket bolted to cylinder carries the fan shaft that is vertically adjusted through a long bolt, which is threaded through shaft, having a check nut on top of fan shaft. The fan shaft is mounted on a ball bearing with an adjustment screwed into fan hub.

Weights

Piston, 3 lb. 6 ounces. Valve tappet assembly, 1 lb. Connecting rod, 6 3/4 lb. Valve, 8 ounces. Valve spring, 4 ounces.

Remarks

As a whole, the workmanship on this motor, both on the vital parts and minor details is exceptionally good; the crow feet holding down the valve guides are nickel plated, and the valve springs of a blue steel finish. The valve caps are made out of solid soft steel, and also have blue steel finish. This motor would make a good service and production job, being well designed, constructed, compact and accessible.

Marine Diesel Engines Discussed by S. A. E.

S. A. E. Metropolitan and Pennsylvania Sections visit Philadelphia Navy Yard to examine German submarine U-117. This boat is equipped with two 6-cylinder Diesel Engines, which formed the basis of the evening discussion at the joint meeting held in Philadelphia.

THE Diesel engine as applied to marine propulsion formed the topic at the joint meeting of the S. A. E. Metropolitan and Pennsylvania Sections held in Philadelphia on January 22. Combined with the meeting was a visit to the Philadelphia Navy Yard where one of the Diesel engines from the German submarine U-117 was shown in operation and where the submarine itself was lying in dry dock and could be inspected.

The New York party arrived at Philadelphia at noon and had lunch at the Engineers' Club, which is the headquarters of the Pennsylvania Branch. After lunch they were taken in automobiles to the Navy Yard, and the entire afternoon was spent in inspecting the submarine engines and the submarine. At 6.30 p. m. there was a dinner at Kugler's Restaurant, and this was followed by a technical session, during which a paper on Modern Practice in Heavy Marine Oil Motor Installation and Development Possibilities was read by Hubert Verhey, head of the Diesel Engine Unit, Emergency Fleet Corporation, Philadelphia.

The U-117 was equipped with two 6-cylinder 4-cycle Diesel engines of 17 $\frac{1}{8}$ -in. bore by a little over 16-in. stroke. Each engine develops about 1250 hp. at 450 r.p.m. One of the engines was set up in the shop for tests, while the other was taken apart for purposes of study. On the submarine each engine is coupled to a double generator, provided with a blower for ventilation so as to permit of increasing the output to be taken from the generator. However, this generator is capable of absorbing only about one-half the maximum power of the engine, and, therefore, in order to be able to run the engine to capacity in the test, two of these double generators had been connected in series.

The 6 cylinders are arranged in the usual way, and their pistons act upon a 6-throw crankshaft with throws at 120 deg. The overhead camshaft is driven through a vertical shaft and two sets of spiral gears. Air for fuel injection is compressed to about 1200 lb. per sq. in., in a quadruple stage compressor, built integral with the engine.

There are two methods of starting the engine, viz., by means of the generator acting as a motor, and drawing current from the battery, or by means of compressed air. Both the inlet and the exhaust valves are located in the cylinder heads, in accordance with conventional practice. The cages of the two valves (which are interchangeable) are cast with water jackets, but cooling water is circulated only through the exhaust valve cages. The two fuel injection valves and the air starter valve are combined and located in the center of the cylinder head. Reversal of the engine is effected by shifting the camshaft lengthwise in its bearings, thereby bringing another set of cams into action.

On an instrument board at the forward end of the engine are located no less than 14 pressure gages. These show the pressure obtained in each stage of compression in the air compressor, the pressure in the starter air tank, in the fuel injection air tank, the pressure on the lubricating oil, the pressure on the cooling water, etc.

Mr. Verhey's paper, read at the evening session, consisted of two parts, the first being an elementary exposition of the principles of the Diesel engine, both in the four stroke and two stroke types, with their various modifications, and the latter consisting of brief remarks on various types of machines actually built. The talk was illustrated with lantern slides.

In the four cycle Diesel engine, the pure air drawn in during the suction stroke is compressed during the following stroke to about 500 lb. per sq. in., at which pressure it has a temperature of between 1300 and 1400 deg. F. Oil is sprayed into the combustion chamber during the early part of the power stroke, commencing a trifle before the upper dead center, and being continued for approximately 12 per cent of the downward or working stroke. There is no appreciable increase in pressure in the cylinder as the fuel is sprayed in, hence there is no explosion or shock. In a two cycle engine the air is admitted to the working cylinder under a pressure of from 5 to 7 lb. per sq. in., obtained by means of a direct driven pump, a detached pump or a rotary blower.

Fuel is admitted either through a needle valve or a poppet valve, which is lifted at the proper moment. Fuel oil in both cases is supplied by a high pressure fuel pump, which discharges around the fuel valve, and as soon as the valve is lifted the fuel is forced into the cylinder by means of high pressure air, the pressure varying from 700 to 1200 lbs. per sq. in., according to the load on the engine. In some instances, provision is made for controlling the lift of the fuel valve by hand from the engineer's stand. According to Lloyd's requirements, direct driven compressors must be of such capacity that they are able to furnish air for two engines at partial load, in the case of twin installations. In other cases, auxiliary compressors of the same capacity as the main compressors are installed. This makes it possible to reduce the size of the direct driven compressor, which then needs to take care of one engine only. The auxiliary compressor in such cases also furnishes the starting air.

By the use of the solid injection principle, it is possible to completely eliminate the air compressor, and this method of fuel injection may cheapen and simplify the engine, but, unfortunately, with solid injection, there seems to be greater liability to carbon formation and smoking. The fuel pumps are either of the suction valve regulation type, in which the suction valve is held open

during more or less of the delivery stroke, or of the variable stroke type. Fuel oil is stored in the double bottom of the ship, is pumped into the daily supply tank, where solid particles have a chance to settle out, and then flows by gravity to the suction chamber of the fuel pump. There are usually two daily supply tanks, each having a 12-hr. capacity. In addition, there is a smaller tank holding a light oil, which is used for starting up in extremely cold weather.

Marine Diesel engines over 750 hp. output are usually of the crosshead type, and resemble marine steam engines in their general structure. Sometimes the construction is open, in which case a gravity feed lubricating system is used for the main moving parts, but lately there has been a tendency to completely enclose the engine and use a force feed lubricating system. Enclosing the crankcase permits of collecting the lubricating oil in a drip pan, whence it is drained off to a sump located low down in the ship. A variable speed oil pump draws oil from this sump, passes it through an oil cooler if necessary, and delivers it into a main distributor pipe running the entire length of the engine, with leads to the main bearings.

In enclosed engines, there is a stuffing box at the top of the crankcase, through which the piston rod passes. As a rule, there is an open space between the cylinders and the top of the crankcase, which allows gases that have passed by the piston to escape into the atmosphere, instead of getting into the crankcase, where they would contaminate the lubricating oil, and this space also serves for the removal of the piston.

The starting air valve serves to admit the air into the working cylinders, beginning at the upper dead-center, and turns the engine over in either direction, according to the position of the reversing gear. Compression takes place in the working cylinders not receiving starting air, creating the necessary heat for combustion, and fuel oil can be admitted to all cylinders at once, or in sets if desired, a device being provided to cut out the starting air as soon as the fuel is turned on, and vice-versa. It is impossible to reverse the valve mechanism unless the fuel is cut off. In merchant marine work starting air is usually carried at 350 lb. per sq. in., although for submarine engines higher pressures are carried, for the sake of quick acceleration.

Cooling water for the cylinder jackets, cylinder heads, exhaust valve cages and exhaust headers is supplied by a pump of variable delivery, to permit of changing the cooling effect with a change in temperature of the sea.

Auxiliaries Separately Driven

On modern motor ships, electrically driven auxiliaries are carried, these including all pumps and an ice machine. Direct current for these auxiliaries is furnished by a suitable Diesel motor driven generator set, which as a rule also takes care of the lighting of the ship. The motor ships also have electrically driven deck machinery such as winches, windlasses and steering gears. Current for this machinery is furnished by additional Diesel motor driven generators. Electric driven hoist machinery has not been used on American merchant vessels to any extent, but European vessels have a complete electric deck machinery outfit. American practice calls for quicker handling of the cargo than this European equipment is capable of, so that the hp. needed is greater and more space will be required in the engine room for suitable equipment.

The field for Diesel engine ships appears to be limited to vessels of from 5000 to 13,000 tons capacity, capable of speeds of from 10 to 12 knots per hour. The bulk of the world's trade is carried in vessels of this range of sizes. The cruising radius of motor ships is unsurpassed.

For instance, a vessel equipped with about 1500 brake hp. engines, carrying 625 tons of fuel oil, has a cruising radius of about 20,000 miles, as compared with 8400 miles if equipped with a steam turbine installation or 7500 miles with reciprocating steam engines.

Discussion

In the discussion the possibility of making Diesel engines double acting was brought up. It was said that there was packing material that would stand up for piston rods, and a particular engine was mentioned with 8 x 12-in. cylinders where satisfactory results had been obtained from the packing. The author of the paper said that he preferred single acting engines.

In reply to expressions by Mr. Davids, the author said that if one fuel pump was used to supply a number of cylinders, the amount of fuel received by each cylinder would depend upon the length of the connection, the number of bends, and the condition of the internal surfaces; in other words, upon the total friction of the connection between the header and the valve. There was only one way of supplying the fuel, and that was by a separate pump for each cylinder. Mr. Sperry asked the author what he thought of the Vickers method of solid injection of the fuel. In reply Mr. Verhey said that the solid injection principle looked very attractive on paper, as it was theoretically possible to save 10 per cent of the power, which was required for compressing air for fuel injection, but, unfortunately, the combustion of the fuel was not as thorough with solid injection as with air injection, especially at small loads. Our Navy had been abroad, and they had learned to tell a Vicker's ship by its exhaust, which was always more or less smoky.

Mr. Cook of the McIntosh & Seymour Co., referring to the alternate systems of lubrication, said that there was a place for both. The Diesel engine cylinder must be lubricated without excess, and gravity lubrication was suitable for use on engines with trunk type pistons. In the larger sizes of engine there was usually a diaphragm between the crankcase and the cylinders, one of the advantages of which was that it prevented salt water from getting into the lubricating oil in the crankcase. As regards the effect of an excess of lubricating oil on the cylinder walls, he recounted a peculiar experience. On one of their engines, one of the fuel valves got stuck shortly after the engine was started. It was taken out and found to be gummed up, was cleaned and replaced, but was stuck again after a short while. After it had been cleaned once more and replaced, it did not take long until there was trouble again, and it was then found that the piston rings were all gummed up. It was eventually found that the oil pipe from the particular compartment of the crankcase, was choked up, so that an undue amount of oil had accumulated in the crankcase.

Mr. Cook stated that on engines of the crosshead type, built in Sweden, they had entirely done away with lubrication to the cylinders, depending on the spray from the crankshaft.

Another point brought out was that oil containing 6 per cent of sulphur is unsuitable for use in Diesel engines, as the sulphur has a tendency to cause pitting of the valves, especially when the engine is operating at small load. Mr. Verhey thought that 4 to 5 per cent sulphur should be the maximum. In this connection Mr. Cook related an experience where one of the exhaust pipes was choked up by an accumulation of sulphate of iron, causing a back pressure on the engine. The hydrogen dioxide of the fuel oil combined with water to form sulphurous acid, and this acid acted upon the iron of the exhaust pipe, producing sulphate of iron.

The Qualities of the Molybdenum Steels

This new alloy steel came into use during the war for aircraft crankshafts, gun shields and similar purposes. Since then, the use of this ore in the making of steel has been carefully analyzed and its qualities developed. This article tells what may be expected in the way of elastic limit, tensile strength, elongation per cent, reduction of area and other required qualities.

IN the course of the war there were introduced into practical use a series of new alloy steels which bid fair to become of great value to the automotive industry. Reference is to molybdenum steels, which are generally of the nature ternary or quaternary alloys. During the war molybdenum steel was used for the fighting turrets of tanks, for gun shields, helmets, aircraft engine crankshafts and connecting rods, and for other parts requiring great strength combined with low weight.

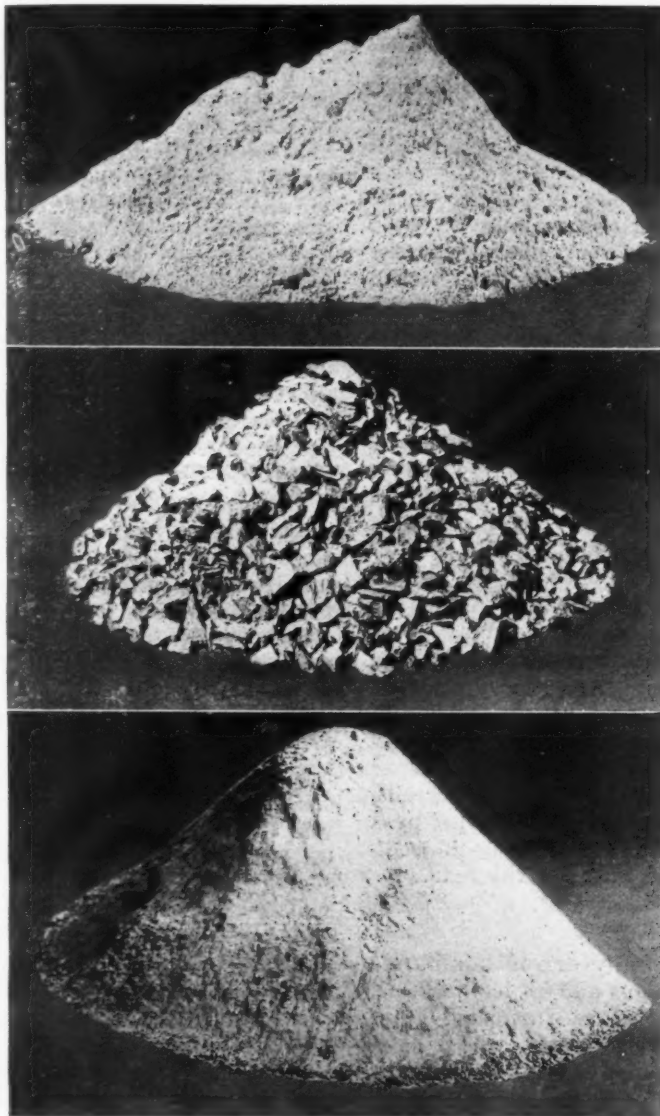
Among the chief advantages claimed for alloy steels containing molybdenum are that it does not require the same care in heat treatment as other steels, as practically the same physical properties are obtained for a range of more than 200 deg. F. in the quenching temperature. Molybdenum improves the static test results of various kinds of alloy steel to which it is added, such as chrome steel, chrome vanadium steel, etc. Moreover, molybdenum steel is said to be easier to machine than other alloy steels and the saving in machining cost easily pays for the cost of the alloying element, it is claimed.

The Element Molybdenum

Molybdenum, one of the metallic elements, has been known for about 150 years.

It derives its name from the word molybdæna, by which most minerals resembling lead in appearance were known in the 18th century. It is produced chiefly from the sulphite molybdenite (MoS_2), which is a mineral very similar in appearance to graphite. Molybdenite and other molybdenum-bearing ores are widely distributed throughout the world.

The metal molybdenum resembles platinum in general appearance, although it is darker and possesses a peculiar



Climax calcium molybdate (top), ferro-molybdenum (center) and molybdenum concentrates (bottom)

lustre. Its atomic weight is 96; its specific gravity is 9; its specific heat 0.07, and it melts at about 4600 deg. F. Despite its very high melting point, it alloys readily with iron, the ferro-molybdenum having a melting point of approximately 2650 deg. F. Metallic molybdenum resists most acids and chemicals to a high degree.

Ore Deposits in Colorado

While its ores are widely distributed, up to a few years ago molybdenum was considered a semi-precious metal, no deposits of any great magnitude having been discovered. A few years ago the Climax Molybdenum Co. acquired possession of a deposit of molybdenum sulphide at Climax, Col., northeast of Leadville. At that point an ore reserve has been developed which at present has a capacity of 1000 tons a day, and it is claimed that the ore already developed insures steady operation for more than 30 years. The entire ore body has not yet been developed.

The ore is broken, delivered to the mill by aerial tramway, ground and concentrated by oil flotation to form 60 to 70 per cent molybdenum sulphide. The concentrates are then converted into ferro-molybdenum or calcium molybdate, in either of which forms the metal can be introduced into steel.

Climax ferro-molybdenum is produced in two grades, both containing from 50 to 60 per cent metallic molybdenum. The regular grade is guaranteed to contain a maximum of 2 per cent carbon, and the special grade, of 0.5 per cent. In the great majority of instances, the former can be used. Climax calcium molybdate contains about 42 per cent metallic molybdenum, the rest being lime. There is said to be no free carbon or sulphur in this compound.

Increases Toughness of Steels

One of the claims made for molybdenum steel is in regard to toughness, and this claim is based on "reduction of area" figures obtained in physical tests. Molybdenum steels of any given elastic limit and elongation are characterized by an extraordinarily high reduction of area. Reduction of area is also said to be an index of machineability. For machine parts requiring a high elastic limit, the cheapest method of manufacture consists in finish-machining the parts directly from the heat-treated forging. This eliminates warping and scaling of semi-machined parts. Furthermore, material submitted to the machine shop is completed without the loss of time and the confusion resulting from intermediate heat treatments. All testing is finished before machine labor is expended upon parts which might have to be rejected later, such rejection involving the loss not only of material but also of labor and tools.

High Drawing Temperatures

One peculiarity of molybdenum steel is that it will acquire desirable physical properties when drawn at a comparatively high temperature. The physical changes accompanying the usual heat treatment are well known. When a piece of steel is heated beyond a certain critical temperature it undergoes a physical transformation. If it is allowed to cool slowly from the highest temperature reached, the process reverses itself and the material returns to its original state. On the other hand, if the steel is cooled rapidly, as by quenching, the physical changes which took place on heating, cannot reverse themselves, and the material then remains in a state of unstable equilibrium. When the quenched steel has been reheated or drawn, physical reactions, which were retarded by quenching, are allowed to take place to an extent proportional to the reheating temperature, and the molecular instability induced by quenching is somewhat modified.

It results from the above that the higher the drawing temperature after quenching, the nearer the approach to a state of molecular equilibrium, and consequently the greater the resistance of the material to any subsequent molecular change. One form of molecular change in steel is that known as fatigue, which is the result of continued mechanical vibration. It is argued that the higher the drawing temperature for given physical properties, the greater the resistance to dynamic stress or to fatigue. Higher drawing temperatures mean ease in furnace regulation and manipulation, and, furthermore, the nearer the approach to the point of molecular equilibrium, the less sensitive is the steel to temperature variations. In other words, wider limits may be allowed in commercial heat treating practice. It need hardly be emphasized that the wider these limits the less chance there is for failure of the treatment and for the necessity of retreatment.

Related to Chromium

In the periodic system of elements, molybdenum is classed as a member of the chrome family. In some respects its effect upon steel is similar to that of chromium. It has been found, however, that by combining these two alloying elements, properties can be developed in steel which are unobtainable by the use of any single element.

Accompanying this article are a number of photo micrographs which bring out the effect of different amounts of molybdenum on the structure of quenched and drawn chrome molybdenum steel. They also indicate the uniformity of the steel when drawn at different temperatures. All of the steels of which photo micrographs are shown were quenched in oil from 1600 deg. F., and drawn as indicated. Steels of two different specifications were made

use of in producing these photo micrographs; all those bearing the number I contain 0.25 per cent of carbon, 0.48 per cent of manganese, 0.18 per cent of silicon, 0.95 per cent of chromium and 0.73 per cent of molybdenum, while all those bearing the number II contain 0.32 per cent of carbon, 0.49 per cent of manganese, 0.10 per cent of silicon, 0.90 per cent of chromium and 0.40 per cent of molybdenum.

Chrome-Molybdenum Steel

If chromium be added to a carbon steel or a nickel steel, and the steel subsequently be heat-treated, their elastic limit and tensile strength are increased (up to a certain point) with the quantity of chromium. However, it is impossible practically to take advantage of the high elastic limits resulting from the addition of a considerable amount of chromium, because it is accompanied by brittleness (as measured by low elongation and reduction of area). For regular commercial purposes the limit of chromium is in the neighborhood of 1 per cent, although for several purposes up to 1½ per cent of chromium is sometimes added. If steel with a normal per cent of chromium is taken and molybdenum is then added, the elastic limit is increased more than it would be by a further equal addition of chromium, and—what is of the greatest importance—the brittleness is decreased at the same time.

Thus a chrome carbon steel, containing 0.27 per cent carbon, 0.64 per cent manganese and 0.99 per cent chromium, when properly heat-treated, showed the following physical properties: Elastic limit, 130,000 lb.; tensile strength, 139,000 lb.; elongation, 16.5 per cent; reduction of area (1 in. round), 58 per cent. Upon the introduction of a moderate amount of molybdenum, so as to obtain a steel containing 0.26 per cent of carbon, 0.64 per cent of manganese, 0.77 per cent of chromium and 0.31 per cent of molybdenum, the following physical properties were obtained: Elastic limit, 143,000 lb.; tensile strength, 151,000 lb.; elongation, 18.5 per cent; reduction of area of 1 in. round specimen, 53 per cent.

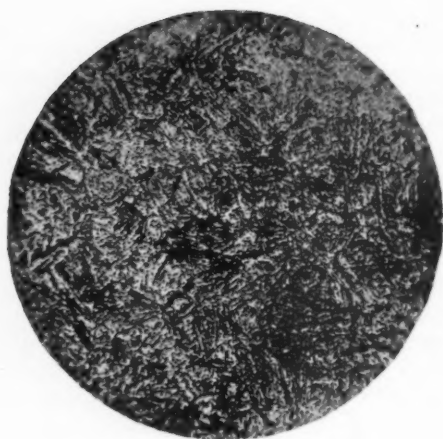
While the results obtained from the chromium steel are of a high order, to obtain them in regular commercial practice requires very careful supervision of the heat treatment and of the chemical composition of the steel. It is claimed for molybdenum that it not only intensifies the effect of the chromium itself, but has an independent effect on those properties of the steel which are undesirably affected by the use of chromium alone.

Chrome Nickel Molybdenum Steel

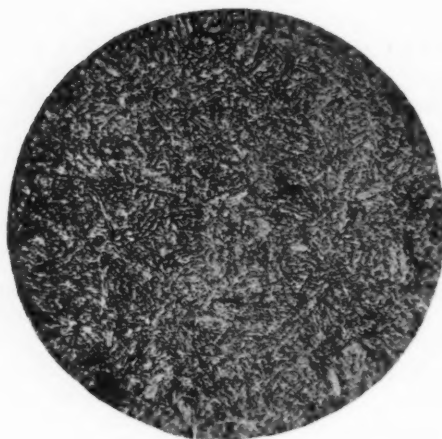
The effect of adding molybdenum to chrome nickel steel is well brought out by the following analysis of a Liberty motor crankshaft. The chrome nickel steel originally used for this crankshaft contained from 0.35 to 0.45 per cent of carbon, 0.50 to 0.80 per cent of manganese, 0.10 to 0.20 per cent of silicon, 0.70 to 0.90 per cent of chromium and 1.75 to 2.75 per cent of nickel. This material showed an elastic limit of 129,760 lb., a tensile strength of 144,460 lb., an elongation of 17.2 per cent, a reduction of area of 53.7 per cent, an Izod impact value of 46 ft.-lb., and a Brinell hardness of 307.

Another grade of chrome nickel steel used in connection with aircraft production during the war had the following chemical composition: 0.28 to 0.37 per cent of carbon, 0.30 to 0.70 per cent of manganese, 0.10 to 0.25 per cent of silicon, 0.65 to 1.36 per cent of chromium and 3.04 to 3.50 per cent of nickel. This showed the following physical properties: Elastic limit, 167,000 lb.; tensile strength, 135,200 lb.; elongation, 19.6 per cent; reduction of area, 51.7 per cent; Izod impact value, 61 ft.-lb.; Brinell hardness, 370.

Liberty aircraft engine crankshafts were made from chrome nickel molybdenum steel made by the United Alloy



Drawn at 700 deg. F.



Drawn at 1100 deg. F.



Drawn at 1300 deg. F.

Type I-A alloy (0.25% carbon, 0.48% manganese, 0.18% silicon, 0.95% chromium, 0.73% molybdenum)



Drawn at 350 deg. F.



Drawn at 700 deg. F.



Drawn at 1100 deg. F.

Type II-A alloy (0.32% carbon, 0.49% manganese, 0.10% silicon, 0.90% chromium, 0.40% molybdenum)

Transverse sections, etched; magnifications, 300 diameters; oil quenching temperature of all specimens, 1600 deg. F.

Steel Corp. of Canton, O. This steel contained from 0.236 to 0.305 per cent of carbon, 0.50 to 0.69 per cent of manganese, 0.09 to 0.15 per cent of silicon, 0.74 to 0.98 per cent of chromium, 2.85 to 3.05 per cent of nickel and 0.32 to 0.54 per cent of molybdenum. This steel tested as follows: Elastic limit, 130,000 lb.; tensile strength, 142,000 lb.; elongation, 20.5 per cent; reduction of area, 65 per cent; Izod impact value, 67 ft.-lb.; Brinell hardness, 303.

Steel Suited for Automobile Parts

For such automobile parts as crankshafts, connecting rods, steering knuckles, steering levers, front axles, etc., grade MO-2 steel is frequently used. Tests on specimens from approximately 4000 finished crankshafts made from this grade, at the plant of a large American automobile manufacturer, showed the following average compositions and physical properties: Carbon, 0.25 to 0.33 per cent; manganese, 0.71 to 0.76 per cent; chromium, 0.45 to 1.04 per cent; silicon, 0.11 to 0.22 per cent; molybdenum, 0.32 to 0.46 per cent. The physical properties averaged as follows: Elastic limit, 131,700 lb.; tensile strength, 149,900 lb.; elongation, 17.7 per cent; reduction of area, 61.8 per cent; Brinell hardness, 304. Chrome vanadium steels used for crankshafts under the same operating and test conditions at the same plant showed approximately the same elongation, reduction of area and Brinell hardness, but the elastic limit averaged only 113,000 lb., and the

tensile strength 127,600 lb. This same steel is used for cold drawn automobile axle shafts, and in this form shows an elastic limit of 145,000 to 156,000 lb. per sq. in., and a tensile strength of 164,000 to 171,000 lb. per sq. in. As an indication of the extraordinary toughness of molybdenum steel, the following results from a class steel containing from 0.75 to 1 per cent of molybdenum are interesting. The test was made on a 1½-in. round specimen 24 in. long. It showed a fibre strength at the elastic limit of 50,100 lb., and a fibre stress at the breaking point of 107,000 lb. The twist degree per in., before failure, was 258.

These results were obtained from test pieces taken from the finished crankshaft, and they should be read in the light of the knowledge that it is possible to draw the steel at from 1150 to 1200 deg. F. The high drawing temperature removes quenching and forging strains, thus eliminating the need for straightening operations during machining. It is stated that the shafts machined exceptionally well.

Nickel-Molybdenum Steels.

The addition of molybdenum to nickel steel containing no chromium results in markedly increasing the elastic limit and the toughness and ductility for a given elastic limit, as measured by a reduction of area and elongation. This effect is particularly pronounced when the steel is drawn

at higher temperature. Nickel molybdenum steels can be readily machined, and can be heat-treated without detriment to their physical properties within a wide temperature range; they are exceptionally homogeneous and free from fibre and flakes. As an instance of the homogeneity of the steel and its freedom from defects, it is mentioned that in the manufacture of the Renault baby tanks, over 99½ per cent of the nickel molybdenum steel parts passed all stages, including ballistic tests, while 76 per cent was the maximum in the case of the straight nickel steel.

The following two tables show that molybdenum steel can be heat-treated at widely varying temperatures without detriment to their physical properties:

TENSILE TEST OF CHROME-MOLYBDENUM STEEL, MO-2
Analysis Range

Carbon	Manganese	Chromium	Silicon	Molybdenum
.23 to .30	.50 to .80	.80 to 1.10	.10 to .20	.25 to .40
Physical Properties				
Water Quench	Elastic Limit	Tensile Strength	Elongation Per Cent	Red. of Area Per Cent
1500° F.	149,600	162,900	16.0	57.2
1550° F.	151,000	163,400	16.5	57.3
1600° F.	148,800	163,600	17.0	57.3
1650° F.	148,500	161,400	16.5	58.9
1700° F.	149,500	162,400	16.5	56.8
All drawn at 1000° F.				

TENSILE TEST OF CHROME-NICKEL MOLYBDENUM STEEL, LM
Analysis Range

Carbon	Manganese	Nickel	Chromium	Molybdenum
.25 to .35	.50 to .80	2.75 to 3.25	.70 to 1.00	.30 to .50
Physical Properties				
Oil Quench	Elastic Limit	Tensile Strength	Elongation Per Cent	Red. of Area Per Cent
1400° F.	175,200	185,000	16.0	52.5
1450° F.	179,300	187,400	15.5	51.5
1500° F.	171,200	182,700	16.5	55.1
1550° F.	174,200	185,100	16.0	52.8
1600° F.	172,700	183,500	15.0	51.7
All drawn at 1000° F.				

It will be seen from these tables that in spite of the wide range in drawing temperatures, there was only a slight variation in the physical properties.

It is also claimed for molybdenum steels that they are less liable to warp in the course of manufacture, owing to the depth-hardening effect of molybdenum, which, among other things, permits the quenching of irregular sections with a minimum of warping. This peculiarity of the steel is of considerable commercial value in connection with oil-hardened parts, as straightening operations during manufacture are eliminated.

What is referred to as the depth-hardening effect of molybdenum is illustrated by Brinell hardness readings taken along diagonal lines of 3½-in. square sections of molybdenum and chrome vanadium steel respectively. The maximum hardness in each case was 293, while the minimum hardness, at the center of the section was 262 in the case of chrome molybdenum steel, and 235 in the case of the chrome vanadium steel.

Five Types of Molybdenum Steel

Molybdenum steels are made in five types, as follows:

- Type MO, chrome molybdenum.
- Type MS, chrome molybdenum, higher carbon.
- Type LM, chrome nickel molybdenum.
- Type NM, nickel molybdenum.
- Type VM, chrome-vanadium molybdenum.

The type MO is made in three molybdenum ranges, as follows: Class A, 0.25-0.40 per cent molybdenum; class B, 0.50-0.75 per cent molybdenum; class C, 0.75-1.00 per cent molybdenum. It has been found, however, that the class A meets practically all commercial requirements and is usually specified.

The MS type of chrome molybdenum steel is used for chassis springs and for heavy gears. The carbon content is made as low as 0.35 per cent for forgings and as high as 0.6 per cent for rivet sets, etc. Besides, the steel contains 0.60-0.90 per cent of manganese, 0.10-0.20 of silicon, 0.80 to 1.10 per cent of chromium and 0.25 to 0.40 per cent of molybdenum. Physical properties obtained in the spring steel are as follows: Elastic limit, 180,000-210,000 lb.; tensile strength, 200,000-230,000 lb.; elongation, 12 to 15 per cent; reduction of area, 37 to 45 per cent.

Addition of Molybdenum to Steel

There has been an impression, based upon past practice, that molybdenum, when introduced into steel, will volatilize or oxidize out of the bath. This is denied by the Climax Molybdenum Co., who assert that the metal can be introduced into steel as easily as nickel, and with recoveries practically as good. Molybdenum, in the form of a ferro-alloy, may be introduced into the steel by any of the customary methods. Recent developments have shown that it may also be introduced in the form of calcium molybdate. With ferro-molybdenum, the alloy may be introduced in the bath just after the charge becomes plastic, and a little before the melt becomes level, when it may be thrown in, casks and all. It should not be added with the charge because of possible loss on the furnace bottom. It may also be added just after the final additions of ferro-manganese and ferro-chrome, that is, a few minutes before the furnace is tapped.

Instead of adding the alloy to the bath, it may be added in the ladle, in which case it is advisable first to melt it, and then pour it into the molten stream after the furnace is tapped. This latter method was the first one to be employed during the war, but it was later replaced by the previously described method. When calcium molybdate is used, it is added in the early stages of the heat, preferable a little before the melt becomes level. Whatever the type of furnace, it is well to remember that the molybdate must come in direct contact with the molten iron, and must therefore be added (in the basic furnace) before the lime begins to come up. Shipped in sheet iron drums or in sacks, the molybdate is added, containers and all.



Pavesi road train carrying load of 25 tons

Aluminum Piston Design*

This discussion divides the problem in two classes and there takes up the details of each class. The four points on which objections to these problems are based—wear, slaps, excessive oil consumption and crankcase dilution—are treated separately.

By E. G. Gunn

FROM a thermal standpoint aluminum pistons may be broadly divided into two classes:

- (1) Those designed with the object of conducting the heat away from the head into the skirt and thence into the cylinder walls.
- (2) Those designed with the object of partly insulating the skirt from the heat of the piston head.

Those in the first class are usually more or less conventional in design except that they have thicker walls, or ribs extending down from the head. They are generally used for high-duty engines. In these engines, which are usually of a rather large bore and comparatively low speed, the weight of the piston is secondary to its ability to keep the head from overheating, and piston slaps are not of much consequence. Therefore, for heavy-duty engines pistons of the first type seem logical. Sections of some of the types which come under the first group are given in Figs. 1, 2 and 3.

Passenger-Car Engines

For passenger-car engines the conditions are somewhat different. The duty is lighter and the bore usually smaller. This lessens the tendency toward excessive heat. Quietness being important, close-fitting pistons are desirable. Need for good accelerating ability and smoothness in operation makes lightness desirable. These considerations

have led to much development work on pistons of the second type. The plan followed in most cases is to partially insulate the skirt from the piston head, thus minimizing the expansion of the skirt due to heat. Some of the ways of accomplishing this are shown in Figs. 4 to 11, inclusive.

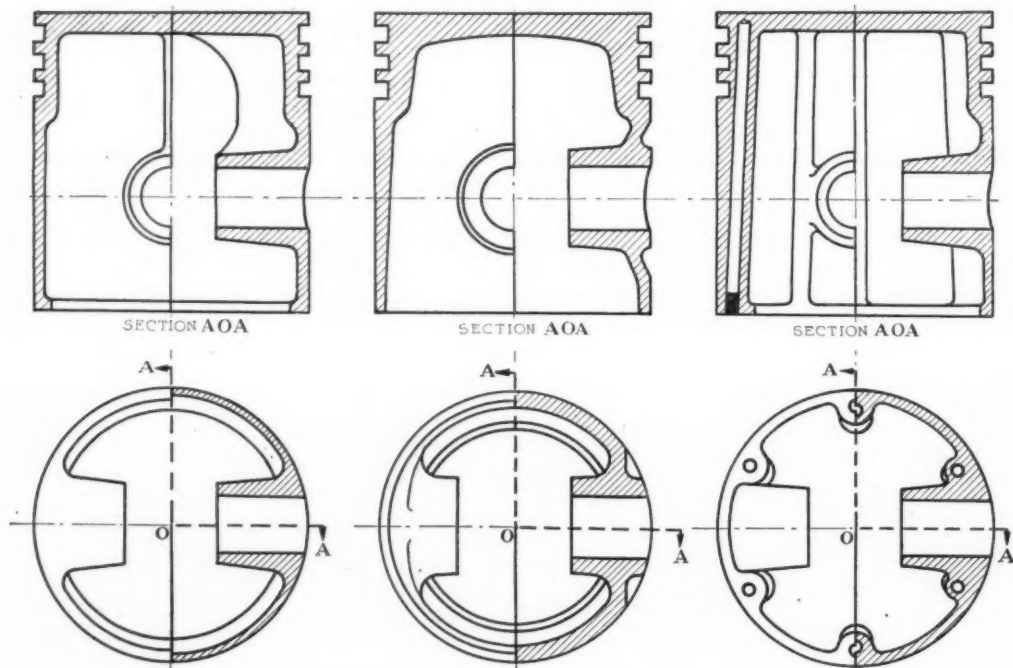
Pistons of the Long and Franquist type are split to allow the piston to spring. They can for this reason be fitted more closely than the more conventional types. The conventional type with the comparatively thin wall is probably the most popular, and for the smaller bores serves very well. It is simpler and somewhat cheaper to make than other types. In all the other types shown there has been an attempt to insulate the skirt from the head. This allows the piston to be fitted more closely, thus minimizing piston slaps.

Four points are often brought up as objections to the use of aluminum pistons. These objections are the same as those encountered in the use of cast-iron pistons.

- (1) Wear.
- (2) Piston slaps.
- (3) Excessive oil consumption.
- (4) Crankcase dilution.

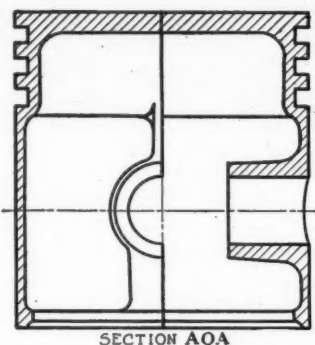
Wear has been shown to be largely a function of original smoothness. It is unreasonable to expect long life when aluminum pistons are fitted to cylinders of relatively hard material having a rough bore. Aluminum has been shown to be a good bearing metal, but it must run on a smooth surface, as in the case of babbitt metal. Much attention is paid to polishing the journals of a crankshaft, but we often see cylinder bores, whether ground or reamed, which are so rough that they can be marked with a lead pencil, although they may appear to be smooth. This is undoubtedly the cause of a great deal of initial wear on aluminum pistons. When cast-iron pistons are fitted this is not so apparent. Dust in the air also plays a very important part in wear. Engines run on the dynamometer give much longer service than engines in cars.

I have lately examined a truck piston with the top ring worn nearly in two, and with over 1/32-in. side clearance. The rings and piston were

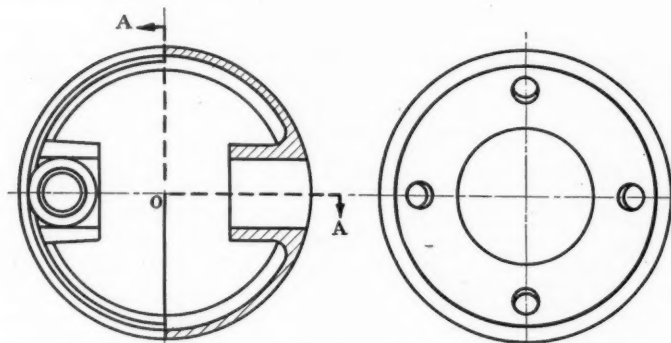
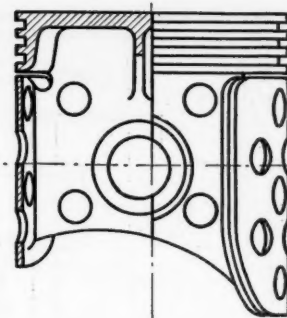
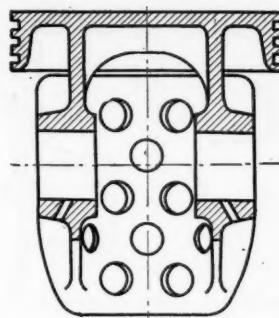
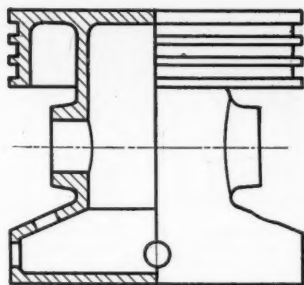


Figs. 1, 2 and 3

*Paper read at the annual meeting of the S. A. E.



SECTION AOA



Figs. 4 and 5

both polished and showed no sign of scoring. This same model has repeatedly stood the same number of hours' running on test with wear so slight as to be hardly measurable. There is no question that an efficient air-cleaning device would greatly prolong piston and cylinder life.

Piston Slaps

Piston slaps can be overcome by using proper clearance. Pistons of the second design tend to make this condition easier to meet. Offsetting the piston-pin also tends to reduce piston slap. With $3\frac{1}{2}$ -in. and smaller bores there should be no trouble due to sticking with pistons of the conventional design fitted closely enough to prevent slaps, provided the piston and cylinder are of proper design. There should be no local hot-spots, and care should be taken in the design to prevent a condition tending to warp the cylinder when heated.

Much trouble was experienced with sticking aluminum pistons in a certain inserted-sleeve engine of about $3\frac{1}{2}$ -in. bore. The cylinder was in the form of a block aluminum casting, with inserted cast-iron sleeves. Clearances up to $\frac{1}{64}$ in. were tried, but still the pistons seized. The sleeves were removed and found to be machined so that there was an air-gap of 0.005 in. between the sleeve and the cylinder wall. These sleeves were replaced with others which fitted all the way down, and pistons with 0.007-in. clearance were then found to be satisfactory.

This is perhaps an exaggerated case, but shows the bad effect of failure to carry the heat away from the cylinder bore rapidly. The top land of the piston must, of course, be given much more clearance than any other part. The next land requires less, and the least clearance can be given to the bottom of the skirt. The tapering necessarily increases rapidly as the top of the piston is approached. When the piston-pin is placed too near the rings, piston slaps are more frequent, for the clearance in the zone near the piston-pin bosses must be sufficient to take care of extreme heat conditions so that under ordinary running conditions this part of the piston has enough clearance to allow piston slaps. When the pin is placed farther from the head the clearance can be small enough to prevent slaps.

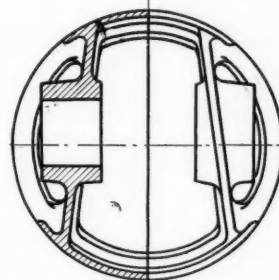
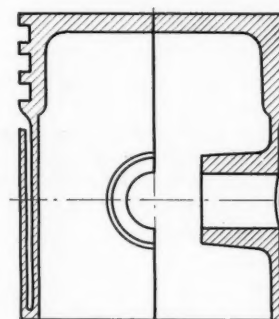
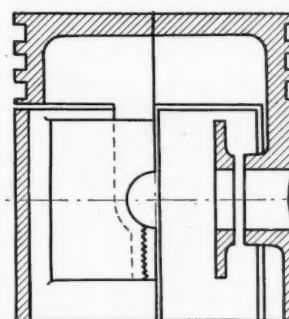


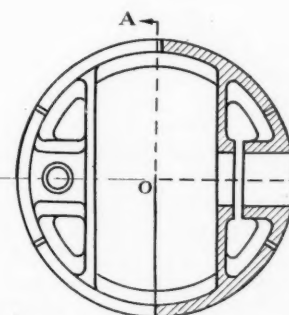
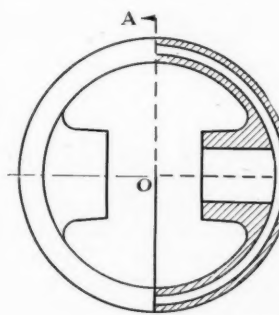
Fig. 6



SECTION AOA



SECTION AOA



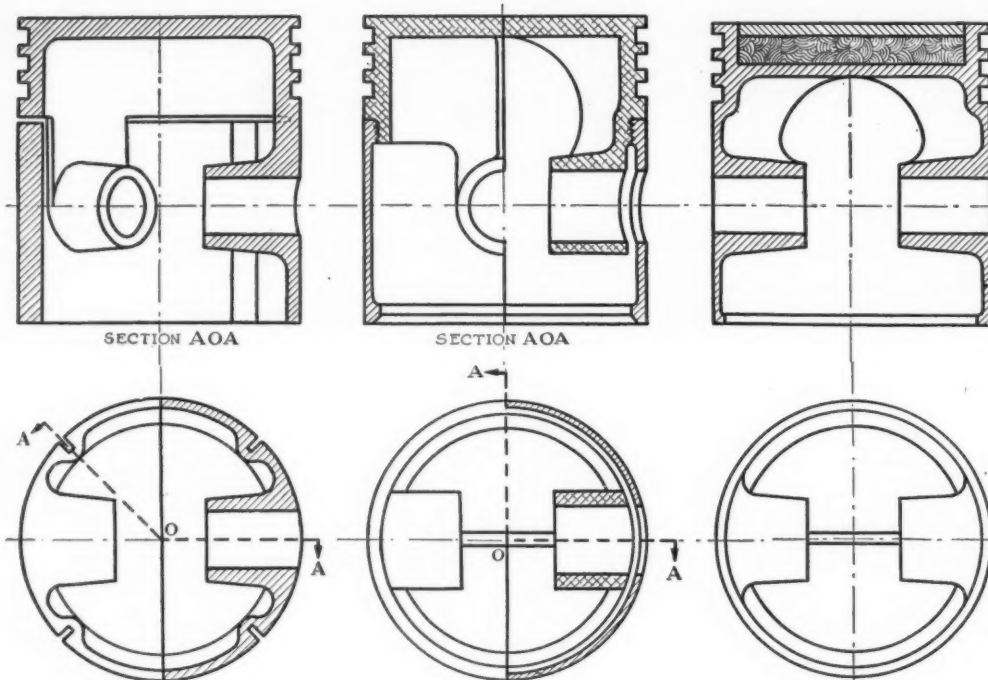
Figs. 7 and 8

Some trouble has also been encountered, due to fitting pins tightly in the piston. When a piston with a tight pin is heated it expands and creeps out on the pin; when it contracts again it hangs to the pin so that the piston has a greater diameter parallel to the pin and a smaller diameter at right angles to it. This condition makes seizing easier and slaps more pronounced. This creeping can be demonstrated readily by applying a blow-torch flame to the head of a piston fitted with a tight pin.

Excessive Oil Consumption

When too much oil is thrown into the cylinder bores, tight-fitting pistons and special rings will not completely overcome the trouble. A great many tests have been run which show this conclusively, demonstrating that:

- (1) With no control on the oil being thrown into the cylinder, rings which seal the top and bottom edge of the groove reduced the oil consumption.



Figs. 9, 10 and 11

- (2) When the oil is properly controlled, the oil consumption is very low even with rings having an up-and-down clearance of 0.004 in.
- (3) With the oil controlled and with hot water circulated through the engine, the volume of liquid in the oil-pan increased, indicating dilution with fuel which passed the piston and rings. This was independent of the kind of rings used.

The engine was next run with a device arranged to heat the mixture to a temperature of about 160 deg. fahr. This was accomplished in such a way that the maximum amount of heat was applied when idling. The effect upon fuel vaporization was observed through a glass window and was clearly evident. The result was to diminish the amount of fuel in the oil-pan when idling, and the viscosity was not seriously affected thereby.

Before the installation of the heating device a black deposit was found on spark-plugs taken from the cylinders of cars on road test even when the oil consumption was very low.

After the installation the spark-plugs remained clean under all conditions. It has been common practice for a number of years to put a

quantity of kerosene in the crankcase oil, when running in an engine to allow the bearing parts to seat more quickly.

It is fair to expect that crankcase dilution has the same effect and that more rapid wear follows; hence the need for minimizing crankcase oil dilution with unburned fuel.

S. S. C. O. Steering Gear Lock

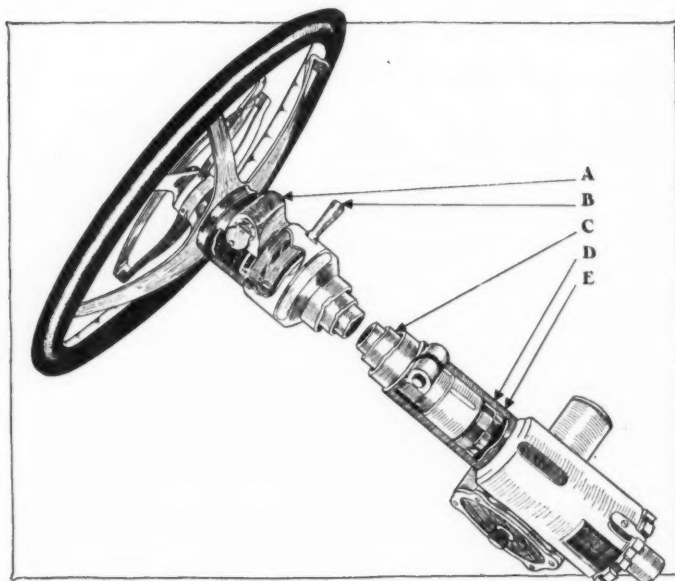
WE show herewith an illustration of a novel lock which is applied to the steering gear of a car. The device consists of a spline fitting, which is cast or riveted into the worm gear housing, and of a machine steel four-spline part attached to a special tube, which can be inserted into any standard steering unit. The lock itself is located immediately underneath the steering wheel. This is said to have hundreds of different combinations, and therefore to be absolutely safe.

This locking device is covered by patents issued to Max M. Muller, and is being manufactured by the U. S. Trade Service Co., Milwaukee. Samples of this lock are now being tried out on Mitchell, Elgin, Kissel and Ogren cars, and we understand that the device has the approval of the Underwriters' Laboratories of Chicago.

The lock holds the steering gear rigid at any angle, and therefore makes driving or towing impossible. As the car can still be readily pushed short distances, it does not interfere with police and fire department regulations. The chief object of the lock, of course, is to prevent theft of the car.

In the illustration A is a 19 tumbler lock which locks the clog when in the proper position by removing the key. B is a lever, used to raise and lower the clogging device C and E. C is a steel tube, attached to the clog at A and to the spline at E. D is the spline fitting, which is riveted or cast into the worm gear housing, and E is

the machine-steel four-spline, screwed into the tube C and secured with a key.



S. S. C. O. steering gear lock—illustrating its important features

How and Why Nebraska Will Test Tractors

More than 100 tractor manufacturers have listed 200 models of tractors to be tested according to the State law of Nebraska. The University of Nebraska is ready to carry on these tests as soon as weather will permit. How this law came into being, how it will operate and what is sought.

SEVERAL years ago a Nebraska farmer by the name of Crozier bought a tractor. It was one of the earlier types when small size outfits were still very much in the experimental stage. Briefly, the description which fits this early tractor best is that it was fearfully and wonderfully made. After getting it out on his farm Crozier tried to make it do all the things the agent had promised him it would do. It failed miserably and completely and was put on the junk heap on the Crozier farm.

This did not discourage Crozier. He had great faith in the possibilities of power farming and so bought a second tractor. This one performed a little better than the first, but still it was only partly satisfactory from the standpoint of this farmer's needs. It finally went the way of the first. Believing in the charm of number three, Crozier invested in a third machine. This one proved to be all that a tractor should be and it has given its owner eminent satisfaction ever since.

How Law Was Passed

Then this Nebraska farmer saw a great light. He reasoned that if there had been an agency or department, under State or Federal supervision if necessary, from which he could have obtained reliable information as to the performance of these three tractors previous to buying them, he would have been saved a lot of grief as well as money, both in the cost of the first two outfits and the loss in his farm operations, due to the failure of these two machines.

It so happened that shortly after these experiences Crozier's neighbors elected him to the State Legislature. One of his first acts on reaching the State capitol was to introduce a bill in the House of Representatives embodying the features outlined above. In the State Senate at the same time was Charles Warner, an extensive farmer, who also had bought his third tractor, and who had had some experiences similar to those of Crozier. Warner championed the bill in the Senate and in due course of time it became the Nebraska tractor testing law, the first of its kind passed by any legislative body.

The law directs the State University to carry out the work of testing one model each of all liquid fuel traction engines offered for sale in the State. The testing station is in charge of three engineers from the agricultural engineering department of the College of Agriculture. These three men are Prof. L. W. Chase, chief of the Department of Agricultural Engineering, and O. W. Sjogren and E. E. Brackett, two other members of the same department's staff. This board has employed Claude K. Shedd, formerly of the staff of

the Agricultural Engineering Department at Iowa State College, to have direct charge of the tests. Following each test Shedd will certify the results to the State Railway Commission, on which it will issue to the manufacturer either a permit or denial, as the case may be, to do business in the State.

What Is Specified

The law specifies that these tests shall "consist of endurance, official rating of horsepower for continuous load, and consumption of fuel per hour or per acre of farm operations." The board of three engineers has outlined the following tests to carry out these provisions of the law according to their interpretation:

(a) Drawbar work at from one-third load to full load for 12 hours. This test gives opportunity for the tractor to "limber up."

(b) Brake horsepower test at rated load and rated speed for two hours. This test will show whether or not the tractor will carry its rated load on the belt; also fuel consumption at rated load.

(c) Brake horsepower test at load varying from maximum to no load with all engine adjustments as in test (b) for one hour. This will show fuel consumption and speed control on varying load.

(d) Brake horsepower test at maximum load for one hour with governor set as in test (b) and carbureter adjusted to give maximum power. This will



Fig. 1—Tractor belted up to electric dynamometer

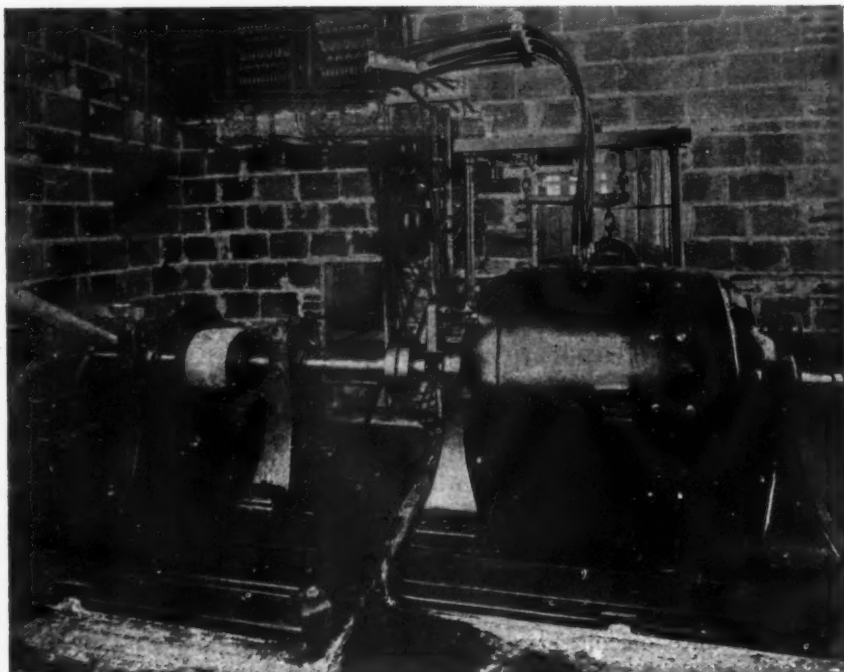


Fig. 2—Installation of Sprague electric dynamometer for belt power test

show the maximum horsepower of the tractor on the belt.

(e) Brake horsepower test at one-half load for one hour with governor set as in test (b) and carburetor adjusted for most economical operation at one-half load. This test will show fuel consumption at one-half load.

(f) Drawbar horsepower test at rated load for ten hours. This will be made on a half-mile cinder track and will show whether or not the tractor will carry its rated drawbar load continuously; also show fuel consumption on drawbar work.

(g) Maximum drawbar horsepower test. This test will be a series of short runs with an increase of load for each run until the engine is overloaded or the drive wheels slip excessively.

(h) Miscellaneous. This may include investigation of work on inclines, turning radius, effectiveness of brakes, or any other feature of the tractor which may seem to require special observation.

(i) Tractors will be under observation for endurance throughout the complete test as outlined above.

The Equipment

The equipment for all tests which may be made indoors is housed in a specially constructed building of hollow clay tile blocks. Here the belt power tests are carried out with the aid of a Sprague electric dynamometer. This dynamometer is driven through an extension shaft mounted on S.K.F. ball bearings to minimize its friction. It carries a paper pulley 10 in. in diameter and with a 12-in. face. The tractor is belted to this shaft and in operating the dynamometer the torque developed is measured in foot pounds which are reduced to horsepower readings. This dynamometer can absorb up to 150 horsepower.

Several belts of various types and makes are provided by the testing station, or the manufacturer may furnish his own belt. The accompanying picture, Fig. 1, shows a tractor set up, ready for the belt power test. The chain and tackle attached to a "dead man" in the rear shows the device used to keep the belt tight. There are two speed indicators, one at the dynamometer and the other at the tractor belt wheel, which makes it possible to record slip-

page. Fig. 2 shows the dynamometer operated by the belt pulley and a part of the resistance coils by means of which the electrical energy is absorbed.

The drawbar tests will be made on an outdoor half-mile cinder track. The original intention was to test the tractors under field conditions, but it was soon demonstrated that it would be impossible to do such testing under uniform conditions at all times, thus resulting in unfair advantages to some outfits and handicaps to others. By rolling, sprinkling and dragging the cinder track when necessary, its condition will be kept as nearly uniform as possible for all tractors under test.

Drawbar Test

The equipment by means of which drawbar power will be ascertained is called a "dynamometer car," or loading machine. Fig. 3 shows this car attached behind a tractor. It must be explained, however, that no actual drawbar testing was done when this photo was taken. The dynamometer car is mounted on a tractor chassis, with the engine removed and a Sprague electric generator installed in its place.

This generator is connected with the drive wheels of the tractor chassis and thus is put in operation when pulled by the tractor under test. The drawbar load can be varied by adjusting the electric load taken from the generator. The dynamometer car will have a maximum capacity of about 30 horsepower, developed at the drawbar. When tractors of larger rating must be tested additional loads will be attached behind the car. A Gulley traction dynamometer, attached between the tractor and dynamometer car, will be used to register the drawbar pull.

The weight of fuel used in each part of the test, except while "limbering up," will be determined and the quantity reduced to gallons at 60 deg. F. For brake tests a tank will be placed on a scale and set at the same height as the tank on the tractor. Fuel will be drawn from this tank on the scale during the tests.

For the 10-hr. drawbar test either of the following methods may be used. First method: Fill the tank to a measured level at the beginning of the test. Fill to the same level at the end of the test, weighing the fuel put in. Second method: Drain the tank at the beginning of the test. Fill the tank, weighing the fuel put in. Drain the tank again at the end of the test, weighing the fuel drawn out. One of these methods may be more convenient and accurate with some tractors and the other method with other tractors. A sample of each order of fuel received will be tested at the mechanical engineering laboratories. All tests will be made on the lowest grades of fuels sold throughout Nebraska on which the tractor manufacturer claims that his tractor will operate; that is, if the manufacturer claims that his tractor will operate only on gasoline, it will be tested on the lower grades of gasoline sold within Nebraska. If the manufacturer claims that the tractor will operate on two or more distinct fuels, for instance, gasoline and kerosene, it will be tested on the least volatile of these fuels, that is, kerosene.

Measuring the Oil

The quantity of oil used will be determined with standard gallon, quart, and pint measures, or by weight when more convenient. The quantity used in the complete test will be determined as accurately as possible. In most cases

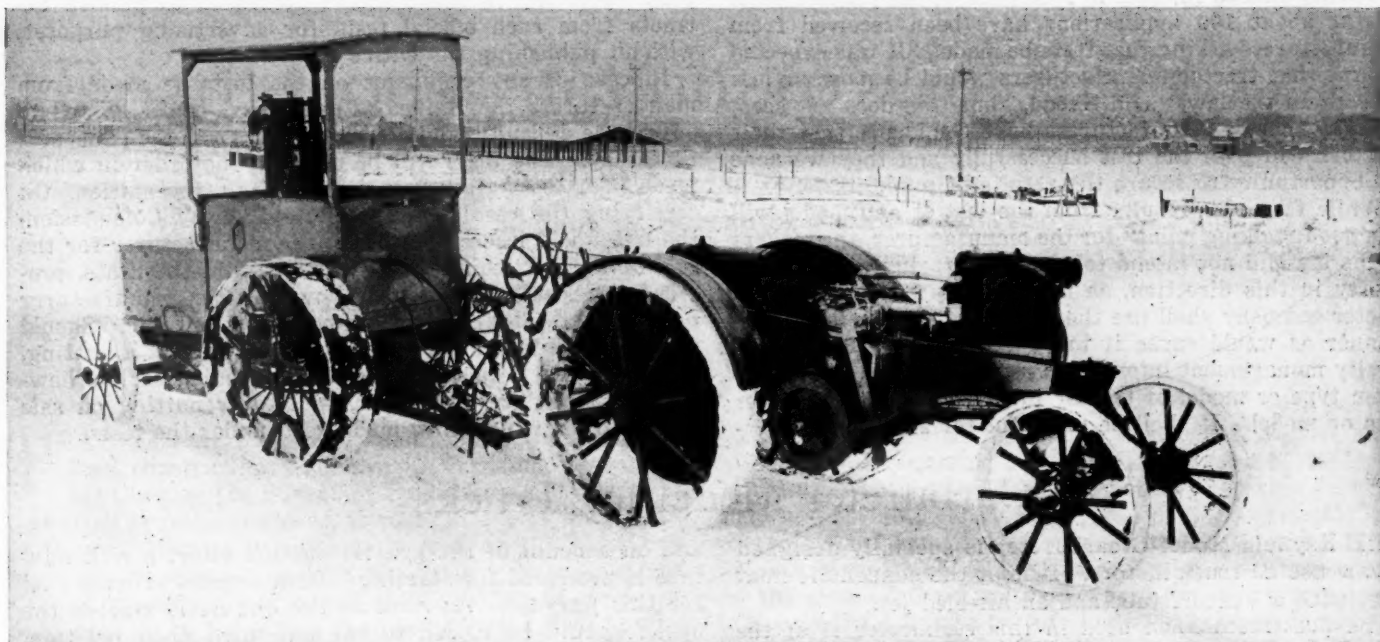


Fig. 3—Dynamometer car for use in determining drawbar pull of tractors

it will not be practicable to try to determine the amount of oil used in each separate part of the test. Samples of all engine oil used will be tested at the mechanical engineering laboratories. In the case of recirculating oiling systems the oil will also be tested at the end of the tractor test or when the oil is drained.

The quantity of water used in each part of the test will be determined by measuring the height of water in the radiator or tank at the beginning of the test and filling to the same level at the end of the test, weighing the water added. If necessary in order to secure accurate results, the water added will be heated to the same temperature as the water in the radiator.

In the test for endurance it will manifestly be impossible to determine the efficient life of a tractor, but the testers expect to detect any features which are likely to give continuous trouble. Observations will be made of all replacements, repairs, adjustments and cleaning; also of any difficulty in the operation of the lubrication or cooling apparatus, or in any other feature of the machine. If undue amount of wear is suspected in any part of the tractor it may be taken apart for examination at the end of the test.

Provision also has been made for miscellaneous tests in order to make observations on any special features of certain makes or types of tractors. These tests may include work on inclines, turning radius, effectiveness of brakes, and any other features which may seem to require special observation.

State Employee to Operate

In all tests made, except the "limbering up," an employee of the testing station will operate the tractor under test. A representative of the manufacturer may do the operating during the "limbering up" test, the object of which primarily is to take out the stiffness likely to be found in a new machine. However, a record of any repairs needed, adjustments made, oil consumed, loads carried, and actual running time will be kept by an observer. This run will last for about 12 hours, divided into three equal periods—the first with one-third load on the tractor, the second with two-thirds load, and the third with full load. While the testing station will furnish the operator for the remaining tests, manufacturers are asked to have their operators present at all times during these tests, to make sure that

their tractors are operated according to instructions, and that the test will be fair to their tractors in every way. Other representatives of the manufacturers also will be welcomed during the progress of the test.

This law was passed by the Nebraska Legislature of 1919. It went into effect July 15, 1919, months before the university was ready to begin testing. However, this delay was guarded against by a provision in the law requiring the Railway Commission to grant temporary permits to manufacturers to do business in the State until tests can be made. The testing station was ready to begin work in October, and actually did start on one test. Two days later a Nebraska blizzard put an end to it, and nothing further will be attempted until the weather is settled in the spring.

Tractor manufacturers who wish to come in under this law are asked to make application for the tests on a form supplied by the agricultural engineering department of the University of Nebraska. This form calls for specifications of the model or models of tractors to be tested. Tractors for testing are to be furnished by the manufacturer f.o.b. the University Farm at Lincoln, where the testing station is located. Fuels will be supplied by the university and charged to the manufacturer at current prices. The same is true of lubricants, although manufacturers will be asked to specify the kinds and grades to be used on the various parts of every tractor tested. All oils will be tested in the engineering laboratories of the university.

Lacking Funds

The law provides that the results of the tests shall "be posted in the Agricultural Engineering Department of the State University and in such other places as may be designated by the State University management . . . and also incorporated in the annual report of the State Railway Commission." It is the plan of the testing station officials to publish the results of the tests in circular form to be distributed at cost to anyone who may ask for them. No appropriation was made by the Legislature to administer this law and funds are at present being provided by the university. For this reason, the board charged with carrying out the provisions of the law has been somewhat hampered.

According to Shedd, in charge of the tests, about 200 models of tractors, made by 100 different manufacturers,

are being offered for sale in Nebraska at the present time. So far about 100 applications have been received from manufacturers asking that tests be made. "It was expected at first that tractor manufacturers would be more or less opposed to the law," said Shedd, "but this does not seem to be the case. Manufacturers have confidence that their tractors will pass the test successfully and they welcome the opportunity to secure the results of public tests."

While favorable results from the test of any model will be a good "talking point" for the manufacturer, the makers of the law did not intend to give manufacturers too much liberty in this direction, as indicated by Section 8: "No tractor company shall use the results of said tests in such manner as would cause it to appear that the State University management intended to recommend the use of any given type or model of tractor in preference to any other type or model. It shall be unlawful for any tractor com-

pany operating in the State of Nebraska to publish extracts from such official tests for advertising purposes, without publishing the entire report."

In case of any complaint on the tests as made from manufacturers the Railway Commission is designated to adjust the difficulty, and a retest may be ordered if deemed necessary. The tests will be made in the order in which models for testing are received at the testing station. On certifying the results to the State Railway Commission, the latter will issue a permit to the manufacturer for the sale of the particular model tested within the State, provided the results of the test show that the manufacturer has made no false claims as to power ratings, etc. Should the tests fail to show a model to be as good as its rating, permit to sell it in the State will be denied. This, however, will not prevent the manufacturer putting on sale other models which have made good under the tests.

Carbureter Model for Trucks

THE Rayfield Model O carbureter is specially designed for use on truck motors. It is of the concentric float type, with a Venturi tube and an air-bled jet.

The float mechanism used in this carbureter is of the fulcrum lever type, and provides for a positive method of controlling the flow of gasoline into the carbureter. And condensation returning from the manifold flows back into the float chamber, which is located directly below the mixing chamber, thereby eliminating leaking and flooding.

Two gasoline levels are employed. The gasoline first enters a reservoir, rising to the top of the standpipe therein and then overflows into the float chamber proper, the flow being controlled by the float in the float chamber. When the level in the float chamber reaches the desired height, the needle valve is closed.

Two nozzles are employed, one for intermediate speeds only, which is supplied with fuel direct from the reservoir; the other for immediate and high speeds, which is supplied with fuel from the float chamber.

Acceleration is facilitated by an accelerating well, located in the reservoir. When the accelerating well is drained, air is "bled" through this well with the fuel. Both the intermediate jet and the high speed jet are constructed for the use of air bleeders; that is to say, air is "bled in" with the gasoline before the latter reaches the nozzle outlet. By the use of two levels and two separate nozzles, it is claimed to be possible to obtain a very thin intermediate running mixture and at the same time sufficient fuel for high speed and heavy pulling. This construction therefore should result in a very economical performing carbureter. There are two adjustments, one a low-speed or idling adjustment, the other an intermediate or high-speed adjustment. Gasoline for idling passes through the throttle shaft when the intermediate nozzle is closed. When the throttle is opened, it acts as a gasoline valve, adding the gasoline from the intermediate nozzle when the throttle is more than one-fourth open.

An air valve choker is used for starting. All air is then cut off,

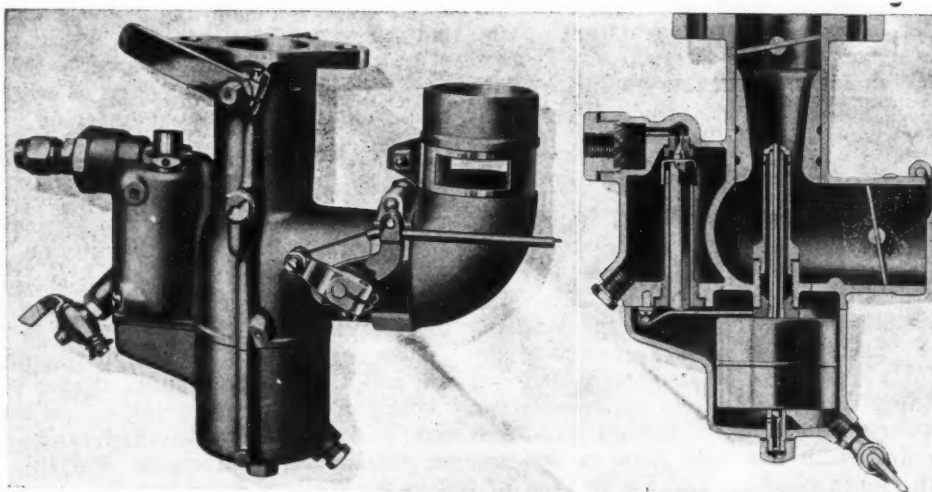
and on account of the greater suction effect a rich mixture is produced for starting. Both nozzles provide fuel for this purpose. As soon as the engine is started the choke should be closed to the one-third open position. This will help to warm up the motor very quickly and to prevent missing and irregular running during the warming-up period.

Flame Propagation

According to W. Mason writing to *Engineering* of London, most of the facts regarding the propagation of flame in open tubes are to be found in the work of Mallard and Le Chatelier. Briefly they are:

1. When an inflammable mixture contained in a horizontal tube, closed at one end and open at the other, is ignited at the open end the flame is propagated for a considerable distance (the magnitude of which depends upon the length and diameter of the tube and on the nature of the inflammable mixture) at a strictly uniform speed.

2. When the mixture is ignited at the closed end of the tube the flame travels with rapidly increasing speed towards the open end. With a mixture of methane and air containing 10 per cent of methane the mean speed of the flame may attain a value of 1,700 cm. per second when the mixture is ignited at the closed end of the tube; whereas with the same mixture ignited at the open end of the tube the mean speed of flame does not exceed 270 cm. per second.



Rayfield model O carburetor for truck engines

Sectional view of Rayfield model O carburetor

Road Construction to Go Forward

Construction has been hindered by war conditions, but will go forward rapidly from now on. Report of Bureau of Public Roads shows that Federal-Aid Road Act has met with remarkable response. More than a billion dollars are now available for road building.

By Allen Sinsheimer

THAT general industrial conditions have hampered road construction is shown in the annual report of the Chief of the Bureau of Public Roads, who reports that of all projects approved, to cost \$91,495,797.99 for the fiscal year 1919, only projects valued at \$18,048,441.97 have been executed. In 1918 the same disturbances and the war caused projects valued at \$41,053,200.67 approved, to be held up to the extent that but \$5,658,458.42 of construction was executed.

The Federal-Aid Road Act has met with a remarkable response on the part of the public, according to the report, and practically all States are now taking advantage of the Federal-Aid allotments. Construction is now going forward more rapidly than at any time in the past two years. Bond issues aggregating \$224,800,000 were authorized and approved by vote of the people, for highway construction up to July 1, 1919, and from all sources, funds amounting to more than \$1,000,000,000 are available for road building.

Road authorities estimate that their organizations will be able to absorb about half of these funds, a statement which, if carried out, will mean that twice as much money will be expended as in any one year in the past. Construction has grown to such immense dimensions, however, as to make the field an attractive one for large contracting firms and the introduction of this element should do much to speed up the work.

Large Appropriations Available

Of the post road appropriations made by the Congress there was available during the fiscal year a total of \$80,000,000, the same being the sum of the appropriations for the fiscal years 1917, 1918 and 1919. From this there was deducted the 3 per cent allowed by law for the administrative purposes and the remainder, or \$77,600,000, was apportioned among the several States. Of this sum there was paid to the States during the fiscal year for road construction work a total of \$2,702,247. At the close of the fiscal year 1918 there had been paid to the States \$425,445. So that the grand total of all payments to the States on June 30, 1919, was \$3,127,693, which left to the credit of the States an unexpended balance of \$74,472,306. In addition, the \$95,000,000 appropriated for the fiscal year 1920 was apportioned to the States, after deducting the 3 per cent for administrative purposes, and that sum became available with the close of the fiscal year. On July 1, 1919, therefore, there was available to the credit of the States for expenditure a total of \$166,622,306.

Approved Projects

During the fiscal year the Department of Public Roads approved project statements submitted by the States for 736 road projects, involving the improvement of 6470 miles of road at an estimated cost of \$91,495,797, and on which \$38,664,397 Federal aid was requested. Up to June 30, 1918, 580 project statements had been approved for

6,249.40 miles of road, estimated to cost \$42,278,770, and on which was requested \$16,049,821 Federal aid. So that on June 30, 1919, there had been approved by this department project statements for a total of 1316 projects, involving 12,719.98 miles of road estimated to cost \$133,774,568, of which \$54,714,219 in Federal aid was requested. At the close of the fiscal year, therefore, there remained to the credit of the States an unallotted balance, including the additional funds which then became available, of \$111,908,087.

Six Thousand Miles to Be Improved

Agreements with State highway departments were executed during the fiscal year to cover 453 of the projects for which project statements had been approved. The estimated cost of the projects covered by these agreements amounted to \$41,598,209, of which amount there was set aside in the Treasury \$18,031,680 as Federal aid. At the close of the fiscal year 1918 there had been executed a total of 224 such agreements of an approved estimate of cost of \$14,820,633, of which there was set aside in the Treasury \$5,899,936. Thus, at the close of the fiscal year 1919 a total of 667 agreements to cover projects had been executed, involving a total approved estimate of cost of \$56,418,843, and a total of \$23,931,617 Federal aid. The projects for which agreements had been executed at the close of the fiscal year call for the improvement of a total of 5,791.23 miles of road.

Under the terms of the Federal-Aid Road Act the apportionments to the States for each fiscal year remain available for expenditure until the close of the succeeding fiscal year, but it is construed that funds covered by agreements are expended within the meaning of the law. Each State had a sufficient amount of funds under agreement at the close of the fiscal year to prevent its losing any part of the funds apportioned to it.

Approval by Office of Public Roads

The Office of Public Roads received 7307 applications for approval for road construction which included consideration of materials involving 68,280,401 gal. of road oil, 56,603,832 gal. of tar, 5,657,390 bbls. of cement, 33,000,000 lbs. of steel, 7,000,000 tons of crushed stone, gravel sand and slag, 2,500,000 linear feet of culverts and pike, 5,500,000 ft. of lumber, 55,059 open top cars, 8,543 box cars and 3,705 flat cars. As a rule the requests were reduced 60 to 70 per cent before they were approved.

The unfavorable conditions in the last part of 1918 prevented construction of national forest roads, but this work is now increasing rapidly. One thousand three hundred and fifty-four miles of national forest roads have been surveyed, to cost \$9,356,967, the majority of them in Arkansas, California, Colorado and Oregon.

The Bureau is exhibiting materials for road construction, and giving lectures constantly throughout the coun-

try for the purpose of increasing the national interest in good roads. It is investigating drainage, having made 126 surveys in thirteen States during the last year. Physical tests of road building materials have been carried on and 1804 samples were tested during the year, including rock, concrete, sand, gravel, slag, cement and other materials.

Statistical information is shown in the following tables as to the status of Federal aid projects, the miles and types of roads included in Federal aid projects, and the expenditure and construction of roads in the fiscal year.

The table below shows the different types of road construction by States during 1919.

Summary of Project Statements Approved and Project Agreements Executed.

Year	PROJECT STATEMENTS APPROVED			PROJECT STATEMENTS EXECUTED		
	Number of Projects	Estimated Cost	Federal Aid Requested	Number of Projects	Estimated Cost	Federal Aid
Reported for fiscal year 1917.....	23	\$1,845,433.60	\$846,151.84	6	\$547,092.25	\$224,717.20
Reported for fiscal year 1918.....	557	41,053,200.67	15,478,089.66	218	14,239,939.15	5,653,458.42
Now reported for fiscal year 1919.....	736	91,495,797.99	38,664,397.41	454	41,631,731.67	18,048,441.97

Federal Aid Expenditures and Related Data for Fiscal Year 1919.

Date	Projects Under Construction	Federal Aid Paid During Month	Total Federal Aid Paid to End of Month	Total Number of Projects Completed to End of Month	Total Federal Aid Paid on Completed Projects	Mileage of Completed Projects
To June 30, 1918.....	.....	.....	\$458,757.60	5	\$166,274.84	17,643
July, 1918.....	155	\$114,376.64	573,134.24	6	208,996.38	21,643
August, 1918.....	193	179,303.58	752,437.82	6	208,996.38	21,643
September, 1918.....	243	196,426.51	948,864.33	6	208,996.38	21,643
October, 1918.....	279	253,529.79	1,202,394.12	11	264,690.25	47,677
November, 1918.....	269	285,940.24	1,488,334.36	11	264,690.25	47,677
December, 1918.....	281	311,751.08	1,800,085.44	12	284,690.25	51,087
January, 1919.....	300	296,014.59	2,096,100.03	16	461,521.81	61,157
February, 1919.....	312	263,760.91	2,359,860.94	24	566,665.13	79,481
March, 1919.....	312	263,591.52	2,623,452.46	31	702,194.88	116,896
April, 1919.....	341	69,038.88	2,692,491.34	31	702,194.88	116,896
May, 1919.....	420	159,176.37	2,851,667.71	35	784,699.84	148,102
June, 1919.....	566	401,807.81	3,253,475.52	38	828,363.30	184,315

State	Total Number of Projects, 1919	1919																						
		Earth		Sand Clay		Gravel		Macadam		Macadam Mat Top		Bituminous Macadam		Bituminous Concrete		Concrete		Brick		Miscel- laneous		Undeter- mined		
		No.	Miles	No.	Miles	No.	Miles	No.	Miles	No.	Miles	No.	Miles	No.	Miles	No.	Miles	No.	Miles	No.	Miles	No.	Miles	
Alabama.....	11			6	35.270	5	37.122																	
Arizona.....	3	1	12.707			1	3.220									1	3.860							
Arkansas.....	5					4	38.250								1	5.000								
California.....	3	3	26.050													1	11.400							
Colorado.....	2	1	19.014																	1	21.000			
Connecticut.....	1											1	7.830											
Delaware.....	3																							
Florida.....	4			2	10.700										1	2.500	2	15.906	1	5.720				
Georgia.....	23	2	19.540	20	209.521												1	3.050						
Idaho.....	2	2	35.770			1	4.000										1	6.520						
Illinois.....	9																9	65.357						
Indiana.....	8					2	23.570																	
Iowa.....	7	3	33.980			2	19.299										3	19.749	2	1.982			3	32.940
Kansas.....	3	1	7.756							1	5.000						1	6.383						
Kentucky.....	13					12	103.178															1	1.660	
Louisiana.....																								
Maine.....	2											2	11.865											
Massachusetts.....	10																10	46.667						
Maryland.....	22					9	44.418	1	4.232	2	10.658			1	1.215	7	25.220					3	16.292	
Michigan.....	13	4	53.310			9	166.370															1	20.400	
Minnesota.....	11	2	27.546			9	63.480																	
Mississippi.....	6					3	43.440					1	2.790	1	2.200							1	9.390	
Missouri.....	4					4	21.210																	
Montana.....	13	10	245.300			1	14.830															2	85.270	
Nebraska.....	14	6	36.630			6	73.700										2	14.740						
Nevada.....	8					5	6.580					1	.950	2	3.550									
New Hampshire.....	4					4	42.225																	
New Jersey.....	5	1	20.620														41	15.338						
New Mexico.....	3																							
New York.....	15	1	17.600	7	65.809	1	3.100					2	16.684			3	19.060					1	7.480	
North Carolina.....	14	13	232.850	1	3.500	1	5.460									3	8.710							
North Dakota.....	18							3	13.710															
Ohio.....	4	1	27.410													2	9.390	1	4.020	4	25.650	9	44.650	
Oklahoma.....	6	2	15.560			2	9.330	1	2.750							2	17.340					1	2.040	
Oregon.....	24											3	18.570	2	26.290	19	92.113					1	18.800	
Pennsylvania.....	3											2	3.190	1	5.000									
Rhode Island.....	6	1	3.530	3	25.090	1	2.140									1	2.120							
South Carolina.....	5	2	23.640			3	28.270																	
South Dakota.....	3					1	15.392			2	23.989													
Tennessee.....	40	2	21.140	2	26.280	14	165.692			12	99.405					1	4.666			2	8.756	8	144.235	
Texas.....	3	2	58.900					1	9.280															
Utah.....	3					3	8.830																	
Vermont.....	16	1	6.750	3	18.314	2	10.982	4	16.720			1	3.234			2	10.777					3	19.970	
Virginia.....	6					5	26.707									1	3.526							
Washington.....	18	1	4.000					1	2.000			3	10.230	1	2.960	10	19.105	2	1.710					
West Virginia.....	46	13	66.346	1	5.750	8	39.760	3	13.490			1	2.410			16	44.200					5	45.302	
Wisconsin.....	3	1	10.410			1	4.120									1	8.000							
Wyoming.....																								
Total.....	445	76	1,026.409	45	400.234	119	1,022.675	16	86.171	15	115.066	17	77.753	12	58.105	102	467.827	9	35.062	3	29.756	39	447.429	

Note.—The difference between the number of projects shown on this report and on the report of project agreements executed is due (1) to the omission of projects covering the erection of bridges only and (2) to the counting of projects twice where they contain two types of construction.

Summary of miles and types of roads included in Federal aid projects executed during fiscal years 1917, 1918 and 1919.

Type	Mileage Approved	Per Cent of Total	Total Cost
Earth.....	1,622,520	28.02	\$6,645,244.86
Sand-clay.....	626,705	10.83	2,657,970.03
Gravel.....	1,601,744	27.67	10,238,677.92
Macadam.....	163,512	2.82	1,823,550.67
Macadam mat top.....	170,078	2.94	1,275,712.95
Bituminous macadam.....	126,204	2.18	3,106,967.48
Bituminous concrete.....	118,170	2.04	2,821,214.59
Concrete.....	590,325	10.20	18,172,084.19
Brick.....	66,828	1.15	2,845,429.91
Miscellaneous.....	37,791	0.65	189,614.53
Undetermined.....	665,992	11.50	6,925,839.97

Forest Road Activities

Little progress was made in the construction of national forest roads during the last six months of 1918 because of the unfavorable conditions resulting from the war. In the first half of 1919 there was a marked increase in road activities, which continued up to the later months of the summer, when the difficulty in obtaining suitable equipment had a tendency to slow down work.

This bureau operates under somewhat different schedule from the Bureau of Public Roads, as the Government is empowered to carry the whole expense of road construction in the national forests and to build highways without regard to state lines. In consequence the U. S. Forestry Service is slowly but surely pushing out a number of interstate highways which will be very valuable in the future, both from an economic and recreational standpoint.

Summary of Forest Road Activities for the Fiscal Year Ending June 30, 1919

State	LOCATION SURVEYS						State	ENGINEERING, INVESTIGATION AND RECONSTRUCTION SURVEYS COMPLETED			CO-OPERATIVE AGREEMENTS EXECUTED				
	IN PROGRESS			COMPLETED				No.	Miles	Estimated Cost of Construction	No.	Miles	Total Amount	Federal	Local
	No.	Miles	Estimated Cost of Construction	No.	Miles	Estimated Cost of Construction									
Alaska.....	2	11	\$77,000	.....	.....	.....	Alaska.....	.....	.....	.....	.....	.....	.....	.....	.....
Arizona.....	4	87	385,000	1	7	\$53,486	Arizona.....	9	204	\$1,223,080	10	190	\$1,019,695	\$488,558	\$531,137
Arkansas.....	1	10	56,927	.....	.....	.....	Arkansas.....	5	94	444,856	.....	.....	.....	.....	.....
California.....	5	77	658,500	5	84	1,377,000	California.....	10	294	1,381,062	7	107	595,900	299,950	296,050
Colorado.....	.....	.....	.....	1	13	54,700	Colorado.....	10	237	1,077,450	9	194	700,833	517,785	183,048
Florida.....	.....	.....	.....	1	27	70,838	Florida.....	.....	.....	.....	1	27	90,000	43,000	47,000
Georgia.....	.....	.....	.....	.....	.....	.....	Georgia.....	1	18	82,247	.....	.....	.....	.....	.....
Idaho.....	2	65	353,524	1	23	175,303	Idaho.....	3	54	877,062	6	189	389,840	205,295	184,545
Minnesota.....	.....	.....	.....	.....	.....	.....	Minnesota.....	1	31	150,000	.....	.....	90,000	60,000	.....
Montana.....	2	34	234,880	4	45	224,248	Montana.....	2	18	70,714	7	36	911,140	51,070	40,070
North Carolina.....	.....	.....	.....	1	10	86,480	North Carolina.....	4	65	525,923	.....	.....	.....	.....	.....
Nevada.....	.....	.....	.....	5	112	405,818	Nevada.....	1	6	28,144	1	19	45,000	22,500	22,500
New Mexico.....	.....	.....	.....	4	23	447,727	New Mexico.....	2	16	42,500	5	73	331,119	238,619	92,500
Oregon.....	2	42	471,503	.....	.....	.....	Oregon.....	3	119	1,037,232	12	238	1,541,550	729,075	812,475
South Dakota.....	1	31	104,400	.....	.....	.....	South Dakota.....	1	31	104,400	3	60	78,400	63,200	42,200
Tennessee.....	.....	.....	.....	2	74	209,950	Tennessee.....	5	73	570,112	.....	.....	.....	.....	.....
Utah.....	.....	.....	.....	.....	.....	.....	Utah.....	1	19	50,050	7	224	593,290	296,645	296,615
Virginia.....	1	10	96,000	.....	.....	.....	Virginia.....	.....	.....	.....	.....	.....	.....	.....	.....
Washington.....	1	11	109,260	2	20	502,552	Washington.....	4	85	1,758,635	6	42	717,692	372,435	345,257
Wyoming.....	.....	.....	.....	1	69	325,000	Wyoming.....	2	21	83,500	6	180	581,600	368,300	213,300
Total.....	21	378	\$2,546,994	28	516	\$3,933,102	Total.....	63	1354	\$9,356,967	81	1610	\$7,746,059	\$3,786,432	\$3,166,727

State	PLANS						State	CONSTRUCTION					
	IN PROGRESS			COMPLETED				IN PROGRESS			COMPLETED		
	No.	Miles	Estimated Cost of Construction	No.	Miles	Estimated Cost of Construction		No.	Miles	Estimated Cost of Construction	No.	Miles	Estimated Cost of Construction
Alaska.....	.....	.....	.....	2	101	\$599,995	Alaska.....	3	14	\$93,000	.....	.....	.....
Arizona.....	4	73	\$335,000	.....	.....	.....	Arizona.....	.....	.....	.....	.....	.....	.....
Arkansas.....	.....	.....	.....	3	16	186,437	Arkansas.....	1	31	72,655	.....	.....	.....
California.....	5	62	867,000	3	87	728,110	California.....	5	34	456,231	1	59	\$73,291
Colorado.....	1	13	54,700	1	27	70,838	Colorado.....	3	89	542,148	.....	.....	.....
Florida.....	.....	.....	.....	.....	.....	.....	Florida.....	1	27	9,000	.....	.....	.....
Georgia.....	.....	.....	.....	1	23	175,303	Georgia.....	.....	.....	.....	.....	.....	.....
Idaho.....	2	65	353,524	.....	.....	.....	Idaho.....	3	38	337,067	.....	.....	.....
Minnesota.....	.....	.....	.....	4	45	224,248	Minnesota.....	.....	.....	.....	.....	.....	.....
Montana.....	3	42	279,842	.....	.....	.....	Montana.....	8	81	349,116	1	4	62,025
North Carolina.....	1	10	86,480	.....	.....	.....	North Carolina.....	.....	.....	.....	.....	.....	.....
Nevada.....	.....	.....	.....	4	81	339,818	Nevada.....	.....	.....	.....	.....	.....	.....
New Mexico.....	1	31	66,000	3	38	390,991	New Mexico.....	.....	.....	.....	1	4	20,000
Oregon.....	7	106	1,383,283	.....	.....	.....	Oregon.....	6	45	757,242	.....	.....	.....
South Dakota.....	1	31	104,400	.....	.....	.....	South Dakota.....	.....	.....	.....	.....	.....	.....
Tennessee.....	1	12	107,561	.....	.....	.....	Tennessee.....	.....	.....	.....	.....	.....	.....
Utah.....	2	74	210,000	6	223	437,000	Utah.....	5	204	387,027	.....	.....	.....
Virginia.....	1	10	96,000	.....	.....	.....	Virginia.....	.....	.....	.....	.....	.....	.....
Washington.....	5	46	907,656	1	2	35,000	Washington.....	4	18	328,757	.....	.....	.....
Wyoming.....	.....	.....	.....	2	138	575,000	Wyoming.....	.....	.....	.....	.....	.....	.....
Total.....	34	575	\$4,851,446	30	781	\$3,762,740	Total.....	39	581	\$3,332,243	3	67	\$155,316

The Need for Federal Maintenance

By PYKE JOHNSON*

The most pressing need in road work today is actual participation in road construction and maintenance by the national government. At the present time government funds are simply distributed to the 48 state highway departments with the one limiting provision that every dollar so appropriated shall be matched by state funds. The law specifically provides that no national funds shall be expended for maintenance and while it does say that roads so constructed shall be substantial in character, statistics supplied by the Bureau of Public Roads show that more than half of the funds now applied on projects are for use in the construction of dirt, sand, clay, gravel and similar types of highways.

These limitations have made impossible either the consideration or the construction of a national highway system. By the very nature of their organizations, state departments are concerned with intra-state rather than interstate needs and, as a result, Federal funds have been distributed over a very large mileage of highways without any regard for the common defense, the needs of interstate commerce or any other purposes which are national in character.

Since government expenditures for maintenance are forbidden, the national appropriations have become merely current expenditures without adequate insurance against loss and as the state is required to match its funds against those of the nation, those sections of the country where taxable valuations are low have been compelled to devote all of their funds to construction without regard for the upkeep of highways already built.

These facts make apparent the need of a broader policy. At one time highway transportation was purely local in character. Today with some 7,000,000 motor vehicles in

use, an estimated production of 3,000,000 more forecast for 1920, there is a constantly increasing chain of traffic which tends to ignore political boundaries and to find its limitations only where physical conditions render communication difficult or impossible.

The need of caring for this transportation both from the standpoint of commerce and for emergency uses is evident as is the fact that these requirements are national rather than sectional and can only be cared for by the nation.

The subject is one which has attracted the earnest attention of road authorities in all sections of the United States. Thought on the subject is perhaps best crystallized into legal expression by the bill which has been introduced in Congress by Senator Charles E. Townsend of Michigan. This would provide for a national highway system, consisting of two main highways in each state of the Union and connected with the highways in adjacent states. Construction and maintenance would be done entirely at the cost of the nation and under the supervision of a Federal highway commission and existing state agencies would be used in the work to the fullest possible extent.

The measure has been subjected to intensive criticism from road authorities everywhere and the principles written into it have been given the endorsement of the National Grange, Chamber of Commerce of the United States, National Automobile Chamber of Commerce and thousands of other organizations reaching into every phase of social, business and governmental activity.

Committee hearings will be undertaken on it at the present session of Congress and once it is made clear to the public what enormous economies may be effected thru such a system as this, it is felt that Congress will respond to the demand and enact the law.

*Secretary of the National Automobile Chamber of Commerce.

New Tire Construction

TWO fabric casings sandwiching a resilient rubber cushion, with an additional rubber tread for road shocks, are the constructive elements of the new Gray outer tire, of Canadian make. The inner or sub-casing is designed to support alone the full internal pressure exerted by the pneumatic tube. The intermediate rubber cushion, although completely separating the two fabric casings, at the same time binds them into an integral structure.

The outer or tread portion has a thick resilient rubber section tapering toward the rim, where it is shaped for fastening by the usual methods. As the entire section at the tread is $\frac{7}{8}$ in. thick, the possibility of puncture is reduced to a minimum. The makers say, also, that the stoutness of structure guards against blow-outs, and that numerous and extended tests under road conditions bear out the claim for long life and efficiency of service.

In this tire the air chamber is smaller than in most types, and in the opinion of the makers the size of the air chamber, within reasonable limits, is not important so far as resiliency is concerned, while the smaller chamber provides against excessive shock if by any possibility the tire should burst. Racing tires, it is pointed out, are seldom of larger size than $4\frac{1}{2}$ in., as those of excessive diameters are considered dangerous for high speeds.

Large tires of the usual type are manufactured for heavy cars with broad treads, but a high pressure must be maintained to support the load, and a strong casing is required

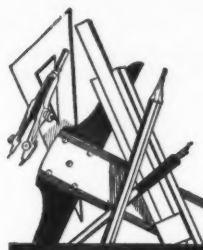
with additional layers of cord or fabric. It is found by experience, however, that the number of layers cannot be increased indefinitely, for if there is an increase above the standard number for each size of tire a separation of plies will occur, owing to the rippling movement of a tire in service.

Ordinarily, if the number of plies is increased the diameter of the casing is made correspondingly larger. By interposing the resilient rubber cushion between the layers, however, the manufacturers say, a practical



A thick tread and a resilient cushion between fabrics are features of this tire

means is afforded for increasing the number of plies of fabric without increasing the width of the tire.



The FORUM



Triangular Belt Drives

Editor AUTOMOTIVE INDUSTRIES:

AT the foot of page 1152 in your issue of Dec. 11 your contributor expresses astonishment "that one or two designers have actually added to the work of the triangulated belt by fitting a water circulation accelerator at the end of the fan shaft." He goes on to predict that there will be very little acceleration of the water flow in such cases, unless the belt is tightened after every two or three hours' running. As the originator of the combined fan water accelerator as applied to Vauxhall cars I should like to point out that in engines which are cooled by the fan and pump system the horsepower absorbed by the pump is virtually negligible in comparison with that absorbed in driving the fan, so that there is absolutely no risk of belt trouble in adding the pump drive to that of the fan.

The important point in all such drives is that the belt should be so arranged that it naturally comes into contact with both driven and driving pulleys. In some cases where the fan belt hangs vertically the slightest stretch causes the belt to come out of contact with the crankshaft driving pulley and nothing short of automatic belt tensioning will keep the drive in working order. On the other hand, inclined belts can be run very slack indeed, and will do many thousands of miles without adjustment.

In a later part of the article your contributor points out that many water accelerators merely churn the water. This may be so, but I can assure him that it is possible to get a delivery of some 100 gal. per min. from a 4-in. diameter impeller providing that the barest common sense is used in the design thereof and its casing.

LAURENCE H. POMEROY.

British Official Tests of Parts

Editor AUTOMOTIVE INDUSTRIES:

IT is the custom here in England that all road trials of cars and accessories shall be undertaken by the Royal Automobile Club, which has a regular department for this purpose. The condition of such tests is that any advertisement must give the whole of the certificates issued; that is, makers are not allowed to publish half the report and keep back any adverse criticisms. Any maker who publishes an incorrect or an unauthorized test forfeits many privileges, among which is the right to exhibit at the Olympia Show.

These trials have taken place for many years, but a new development has just taken place in that the Society of Motor Manufacturers and Traders, Ltd., has made a special arrangement whereby Faraday House—which is the standard engineering test department supported by the Government—can make tests of any engines and other motor apparatus in general, which cannot be tested properly on the road in the first instance. This new arrangement will enable engine makers and others to have proper tests with-

out having, as in the past, to combine their test with that of some car, and thus suffer by comparison if there should be any defect of the car quite outside their own particular feature.

BRITISHER.

London.

Inlet Manifold Design

Editor AUTOMOTIVE INDUSTRIES:

EVERY automotive engineer is alive to the increasing need for improved methods of distributing the explosive mixture to the cylinders of an internal combustion engine. This need has been aggravated on account of the inclusion of fuel with high distillation points in larger quantities in modern gasoline.

While such a problem is generally acknowledged, the fact is not fully comprehended that manifold design is a special science. Not only so, but the manufacture of the article, when correctly designed, must be properly carried out. In fact, the design and construction of intake manifolds is now the one problem in automotive engineering which has not been generally solved.

For many years past resort has been made to heating in a haphazard manner in order that the latent heat of evaporation of the fuel should be supplied either by the circulating water or the exhaust. Water heating, the earlier method, can at the best be only a makeshift, by reason of temperature limitations. The first desideratum is that the temperature to which the fuel is subjected should be at least equal to that of the boiling point of its least volatile fractions. With water this is impossible, as the temperature of boiling water is considerably below the end point of the most volatile gasolines. Water can only warm the total air, thus reducing its mass, without attaining the desired result.

A combination of the inlet manifold with the exhaust, while providing the desired temperature, does not apply it only to the particular areas where high temperature is required; therefore, too much heat is applied, which results in a loss of volumetric efficiency in the engine.

At the S. A. E. summer meeting in 1912 the matter of inlet manifold design was discussed at some length by the present writer, and his arguments have subsequently been indorsed by other engineers. Early in 1913 he turned his attention to what is known as the hot spot manifold and took out patents for this method of treating fuel.

Since that time he has evolved various improvements, principally regarding supercharging features and the elimination of liquid from the crank chambers of engines to which his devices are applied. Another thing on which a patent application has been filed is a method of direct control.

Arrangements have been made to carry out a series of demonstrations in the near future for the benefit of interested manufacturers. A company will also be formed at an early date to manufacture manifolds for certain sizes and types of engines, under the supervision of the writer.

ROBERT W. A. BREWER.

Worker's Opinion of Company Dependent Upon Actions of Minor Executives

The average worker is ignorant of the aims and ideals of the firm for which he works, and his loyalty to the company is affected largely by his personal relations with his immediate superior. Mr. Tipper points out that more than mere technical skill is necessary in the minor executive.

By Harry Tipper

FROM time to time in conversation with manufacturers or men in control of large operations in any line of business, the difficulty of finding supervisors or executives who are capable of handling other men will come into the conversation. There seems to be almost a universal agreement as to the difficulty. In some factories and in some large organizations, steps have been taken to train executives or supervisors in the particular requirements of their work. In some of these organizations the matter has gone so far as to require supervisors of larger responsibilities to understudy themselves in the building of their organization, so that they would be divorced from the detail and be able to spend more time in constructive thought in connection with their operations. In many factories the training of foremen and sub-foremen has been going on for a long time, and the books which have been used in these training schools are indicative at once of the lack of education which is characteristic of our school system, and secondly, the limitation of the training within the factory to the operating side of the business.

Qualifications of an Executive

We have recognized for a long time the importance of securing certain qualities in the men who have to deal with our customers and with the general public, upon whom the business depends, so we expect in such cases, a knowledge of people and some considerable degree of tact, and diplomacy, and understanding. We have recognized for a considerable time that the customer who is discourteously received, whose problem is not understood and who is not handled with proper tact, does not blame the individual with whom he comes into contact, but lays the blame upon the organization. The genial gentleman, whom you know as the chief executive of a large company, whose ideals and personal qualities you find it necessary to admire, does not coincide at all with the idea prevalent in the trade as to the company which is charged with being guilty of arbitrary action and unfair rulings.

Personal Relations Important

We are only beginning to sense, however, the fact that the supervisors and the executives who handle the men and women comprising the workers in the organization carry the same responsibility with respect to the workers that the salesmen and sales executives exercise with respect to customers.

The rough manner and the brusque expression of a foreman is not charged to him by the worker, but is charged to the organization, and the organization suffers.

The quality of understanding the other man is more important in all supervisors who have charge of other workers than it is in salesmen who must meet customers, because the supervisor and his subordinates must work

together every day and for a considerable number of hours each day. Such an intimate contact makes it impossible to preserve a mild disagreement or a mild liking, which is somewhat impersonal and which does not affect seriously the business dealings. There must be established in this intimacy a degree of dislike or liking which is quite intense in its character and by and by affects every action of the worker.

Further, the organization is likely to suffer the worst of it in the dealings between the subordinate supervisor and the workers who are under him, because he is much more closely associated with those workers than he is with the heads of the company itself. His tendency is to magnify the value of his own work where it is likely to please the worker; and where his actions are likely to disgruntle the worker, he is apt to shift responsibility to the company. Many times in my factory experience I have heard the foreman say to his group: "Well, you see that I have been able to put it over for you boys; I had a pretty hard fight, but I finally fixed it," or in another case, "Well, it's too bad, but the company's orders have to be carried out."

The Worker and the Company Ideals

The worker suffers from an almost complete ignorance of the plans, purpose, ideal and character of the company that he is working for, or the officials who make up the company policy.

The only man with whom he comes into intimate contact as respecting the policies of the company is his immediate supervisor and this man himself is frequently almost as ignorant of these policies and their value as the worker himself. It is not enough that this supervisor should be able to see that the operations are properly carried on under his care or that the workmen are kept supplied with material and that the time is usefully spent. Inasmuch as he represents the policy of the company he should be sufficiently a party to that policy, to understand it, and to be instructed upon his part in the responsibility of carrying it out. It is interesting to note that Whiting Williams, Director of Personnel of the Consolidated Pressed Steel Co., who worked for seven months as a laborer in order to get the workers' point of view, gives the following as primary causes of discontent:

"These," he said, "were the pre-eminent importance of holding a job; the terrible danger of being forced into joblessness; the unholy alliance between tiredness and temper, between fatigue of body and mind, which gives opportunity for agitators to work upon the feelings and sensibilities of the worker, and the almost complete ignorance of the average worker as to the plans, purposes, ideals and character of his employer."

You will notice that wages are not named in this state-

ment except in so far as they relate to the economic fear of being jobless, which is always the great fear of the people who live among the 75 per cent of the population who must always suffer if they cease working.

Psychological Causes Fundamental

Otherwise, these primary causes, as stated by Mr. Williams, are psychological and agree very fully with the discussions which have occurred in this publication. Because these primary causes of discontent are psychological in their character, it is, of course, the psychological reaction between the supervisor and his subordinates which is so important a condition of his work. If the workers are contented, if they respect their supervisor thoroughly, and if they can depend upon his justice and understanding they will see that the operations are conducted without confusion and with very little supervision necessary. If these things are not to be found in the relations between the supervisor and his subordinates, no amount of knowledge of the operations will keep the work smoothly and at maximum production with all the supervision that can be provided.

The examination of the training which is being undertaken for sub-foremen and foremen in some of the larger factories, raises the hope that a better class of supervisors will be provided as the result of such measures, and the activities of companies who have gone extensively into the matter, like the Packard Motor Car Co., are of great value to industry at this time.

Two Omissions in Foreman Training

There are, however, two important omissions in the work of such establishments, in the choice of foremen and in their training for their position. These omissions are sufficiently important to decrease the value of the present methods very seriously in their total result, and they exhibit themselves not only in the training of factory supervisors, but in the choice and development of executives of all kinds, under all sorts of conditions.

Ordinarily the man who becomes the supervisor is chosen for that work because of his industry and his ability with respect to his previous job as subordinate. This would be all right if his situation could be limited to operations and was not obliged to include the personalities of the subordinates and the quality of intelligence which is necessary in order to meet these personalities, understand them and work out difficulties with them. The trouble is that skill in the performance of an individual operation and the exercise of proper industry in its pursuit do not indicate what might be termed the potential capacities of the individual.

The man who complains of the lack of democracy in an organization and is irritated by the impossibility of individual expression may be an autocrat in his habit of mind and his taste, and may not recognize that fact himself. The man who is good-tempered, patient and industrious in the pursuit of one operation may become utterly confused and irritable when he is called upon to keep in mind and balance a number of operations, and the man who has been a good organization man in the place where the work is strictly defined and limited may prove to be a politician and a disturber when the work becomes less definite and the limitations become wider.

The Employment Manager

It is true that in large organizations the employment manager has improved the situation very greatly and the limitation of the power of the supervisor by removing his right to hire and discharge has had a good effect. Joint

conferences and other pieces of machinery have also been of value in their way.

The difficulty with the employment department rises from the fact that where so many people must pass through the hands of such a department there is a tendency for the methods of examination to standardize themselves into a system and therefore to miss the very potentialities which it is desirable to find. Similarly, the limitation of the power of the foreman or other supervisors does not improve his capacity, but simply removes some of the danger in his free exercise of his power. The question of the personnel of supervisors is so important a matter in industrial organizations that it should be studied as a separate function of that organization and the man who is responsible for its study should be an executive with large powers, chosen with great care for his human wisdom and understanding, and hampered by few limitations.

These discussions have emphasized from time to time the importance of the small matters in connection with the relations between the worker and his immediate supervisor. These seeming injustices and small irritations arise mainly from lack of understanding on the part of the supervisor as to the workers' individuality and lack of knowledge as to the company's own policies.

Mr. Williams stated further in the speech from which the previous paragraph was quoted, that the radicals had it on the employer group chiefly because they have been industriously engaged in putting salt on the raw spots among the workers. It is an unfortunate commentary upon the supervisory organization in our industrial establishments, that the raw spots should be so much in evidence that they can be salted to this extent.

We have passed from the day when the supervisor was analogous to the slave-driver and was expected to get so much work out of subordinates without regard to how it was accomplished or the psychological results in the attitude of the subordinate towards the organization. But we have not yet arrived at the point where we are prepared to construct an organization personnel in the supervisory body in which one of the chief requirements is human understanding, a knowledge of square dealing and sympathy with ignorance.

Segregated Personnel Work

Very few organizations have segregated the question of personnel in the hands of a man of wisdom like the gentleman quoted in this article. The records of meetings of the managers of industrial relations, of industrial engineers and of personnel experts, do not encourage the hope that these gentlemen are aware of the character and the magnitude of their job.

Discussions relating to the training of supervisors deal very little with qualities of mind, with the psychological values and with the necessity for organization understanding. They constantly emphasize the operating duties at the expense of these more important matters. It is refreshing to find a man who has been sufficiently interested in the human side of his work to get some knowledge of it at first hand, and the conception which he has secured from that experience is equally important.

No matter how much the officials of the organization may appreciate fair-mindedness, justice, understanding and a square deal, no matter how much they may practice it individually, the judgment of the worker will rest upon the relations between himself and his immediate supervisor and the good name of the concern depends more largely upon the actions of the foreman and subordinate officials than it does upon the ideals of its directors.

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Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907, and The Horseless Age (semi-monthly) May, 1918.

Molybdenum Tool Steel

IN the past all so-called high speed tool steel was high tungsten alloy steel, but during the war another alloy with high speed properties was discovered which may possibly become a serious competitor to tungsten steel. High speed steels containing no tungsten have been placed on the market recently and announced with a certain air of mystery. The fact that molybdenum when added to steel in considerable proportions, tends to give it high speed properties, has been known for a considerable number of years, but owing to the comparative rarity and high cost of molybdenum, no efforts to produce such steels commercially were made until the war caused an extreme shortage in the tungsten supply.

It was soon found, however, that the production of molybdenum high speed steel was surrounded with difficulties. Evidently, some of the phases of the alloying process have not been fully mastered, for it was found that while at times excellent results were obtained from a certain mixture, at other times the high speed cutting properties were entirely missing,

although the chemical composition was exactly the same.

Whatever developments occurred during the war period had to be kept under a bushel, for obvious reasons. Now, however, that the censorship has been lifted, we are being acquainted with the fruits of war-time industrial progress. In the case of molybdenum high speed steel, contradictory claims are made which only time can settle. It seems to be the general opinion that to overcome the instability of the steel, it is necessary to add some other alloying element, but differences of opinion exist as to what this stabilizer should be.

A controversy concerning this question has been going on in the British press, both lay and technical. One investigator claims he has solved the problem by means of vanadium, but others hold that the use of vanadium, while it may succeed when the work is being carried on in a small way experimentally, has proved a failure in regular commercial work, and they claim that cobalt is the element that will eliminate all risk of failure.

It seems to be agreed that under certain conditions molybdenum steel excels tungsten steel. That failure is sometimes met with in manufacturing, is no doubt due to imperfect knowledge of its behavior during the alloying process, but there is no reason to doubt that this problem will be fully solved before long, if it has not been solved already, and that we will then have another choice for high speed tool steel.

Practical Tractor Tests

AMONG the things which they do better abroad must be counted tractor trials. We are reminded of this by the official report of the Lincoln (England) trials held last fall, of which a copy has just been received. This report is of a most comprehensive nature, giving the regulation of the trials, the technical advisor's report (including numerous tables and charts of performance), brief descriptions and specifications of all competing tractors, and the judges' report, which latter is in two parts, covering tractors and plows respectively.

A report of this sort is certainly most desirable and should add greatly to the value of the trials. Those interested in tractor performance are thus enabled to study at leisure, the actual record of each competing tractor, which should enable them to obtain a much more definite idea of the relative merits of the different machines than the fleeting impression they receive upon seeing the machines at work. It is not our purpose to convey the impression that a short trial like that at Lincoln can definitely settle the question of the absolute merit of each competing machine. But with all the work done carefully observed and all records well kept and placed before the interested public in a handy form, it would seem that the ordinary trial of moderate length is conducted to the very best advantage, from the standpoint of the competitor as well as that of the public.

It can hardly be doubted that if dynamometer, fuel consumption and similar tests had been held in con-

nection with our so-called national demonstrations of the past several years, we would never have heard of legislation compelling makers to submit their machines to tests by boards appointed by the State Legislatures. Assuming that the farmers are behind this legislation—which assumption is a fairly safe one—they want public tests in which they can have confidence, and if they had been furnished such tests voluntarily, they would not have gone to the legislatures.

Making the Justice Idea Function

THE abstract idea of honesty and justice is present in almost every man. Ask any employer if he believes in these fundamentals and he will certainly answer "Yes." The practical application of the idea, however, is difficult.

It is necessary for the employer to thoroughly understand three things before he can hope to successfully interpret this idea in actual practice:

1. Exactly what he himself wants.
2. What his employees think he wants.
3. What his employees want.

An exact knowledge of these three factors will furnish a basis upon which may be built a structure of industrial co-operation.

The employer cannot carry out a successful plan unless he thoroughly understands what he is aiming for. One large plant instituted a "welfare" department at the beginning of its operation. During eight months the head of the department was changed four times, the name of the department twice, its place in the organization four times, the scope of its activities three times, and finally a Y. M. C. A. was established under the supervision of the management which duplicated the work of this department to a large extent. The work accomplished by this troubled department was, of course, almost negligible in its total effect. It could not be otherwise.

Though this case is probably an exaggerated one, it happened in a plant which employs 12,000 men and which was engaged in essential war production work. The same thing has happened in many other plants to a lesser extent. The employer must know what he wants before he starts.

The second point is just as important as the first; it is, in fact, the cause of more difficulty than either of the other two. The employer has too often gone blindly ahead with the best intentions in the world, and has failed because he neglected to find out what his employees thought about his efforts.

It is essential that the aims and ideals of the employer be made plain to the employees; otherwise it is impossible for the latter to give their enthusiastic co-operation. To make his ideas of justice function effectively, the employer must learn the employees' conception of the aims of the management.

Finally, the employer must ascertain whether or not his idea of justice coincides with that of his employees. In making the idea function, employer and employees must meet on common ground, and unless the employer understands the ideas and the point of view of his workmen, this is impossible.

It is not easy to find out these three things which are essential to a successful application of the idea of justice. To learn them properly three other things are necessary:

1. Study.
2. Patience.
3. Enthusiasm.

Of these three, probably no one is the greatest. Hastily established, carelessly conceived welfare schemes, industrial democracy plans, etc., are not only ineffective but destructive to morale. The installation of any such plan should be preceded by much careful study, investigation and planning; and the plan should be installed, finally, with an enthusiasm that will convey itself to the workers who are to co-operate in its operation.

Airplane Export a Defensive Measure

THE country that develops an export trade for airplanes in addition to domestic trade, will find itself well prepared aeronautically in event of war.

The use of airplanes speeds up business. In case of war, industry will demand the same number of airplanes, and perhaps more, so that it may increase production. If this country develops a domestic and foreign trade for airplanes, in emergency it can divert the productive capabilities devoted to the export trade for defensive purposes and for industrial production. In other words, if this country manufactures 1000 planes per month for domestic commercial use and 1000 planes per month for foreign commercial use, if war comes, it can divert the 2000 plane production to military and industrial purposes. The foreign country will suffer.

What Carelessness Costs

SOME American firms that are anxious to establish themselves in the export business are wasting opportunities through careless office methods and routine. This is shown by reports that are reaching the U. S. Bureau of Foreign and Domestic Commerce.

This Bureau announces certain trade opportunities that are reported to it by the consuls. These trade opportunities are printed in business papers, those referring to automotive inquiries appearing in *AUTOMOTIVE INDUSTRIES*. Recently the consuls have complained that American firms are extremely careless in the correspondence with these inquirers. One inquirer received three replies. As printed, the inquiry plainly stated that he wanted lines to handle on a commission basis. Two of the replies from American firms quoted him only on a cash purchase basis. One of the letters was a ready-made form and reached this inquirer undated and unsigned. The third letter merely listed the articles made by the firm, without reference to price, quality or terms.

It would seem that in looking for trade from a foreign country a manufacturer could afford to give to the prospect enough time to write a letter that would seem to apply to the situation.

Dealers Urge Propaganda by Makers to Boost Tractor Sales

Mississippi Valley Association Incorporates at Annual Convention and Passes Resolutions Asking Co-operation from Factory—Elect New Officers

ST. LOUIS, Jan. 26—Propaganda by the manufacturer is the surest way of converting the farmer to a belief in the efficiency of the tractor, according to resolutions adopted by delegates who attended the Mississippi Valley Implement Dealers' Association convention, just closed in Kansas City.

Advertising campaigns by dealers and distributors do not carry the conviction that the farmers demand, delegates said, and the only sure way to win the farmers quickly, is by a thorough campaign from the factory. With the name of the maker signed to literature telling advantages of motor equipment, they said the actual business of putting the tractors on the farms could be made easy.

Twelve opinions expressed by delegates were:

John Bevan, Southwick & Bevan Implement Co., New Cambria, Mo.—"In the last two years in our community we sold 15 tractors. We consider this a fair sale for the extent of the population, but I may venture to say that it has taken an undue amount of time and expense to sell that number and the fault lies mainly with the manufacturer. He has not co-operated with us in the proper way. Much of his energy has been devoted to unproductive enterprise."

Eugene Seibert, Seibert-Schoepp, Belleville, Ill.—"The farmer is not yet convinced that the tractor has its advantages over the horse. If he has the interest to inquire about the tractor, it does not mean that he is going to abandon his horses. It's mere inquisitiveness and a degree of curiosity. It takes tremendous argument to persuade him to a proper impartial view. I believe it is the trouble of improper advertising."

Paul Jackson, Jackson Farm Implement Supply Co., Franklin, Ky.—"In Kentucky the farmers are beginning to realize the benefits obtained from using motor tractors. On the whole, however, much education remains to be done. It is natural during a period of transition from horses to automotive power that some skepticism should exist, but most of the dealers feel that there is an undue amount of it caused by improper adjustments on the part of the distributors."

O. E. Fullrich, William Fullrich & Son, Jamestown, Mo.—"Very few farmers in our community who once have bought and used tractors are willing to go back to the hand plow. But we found difficulty in making that original sale. I believe the manufacturer can help us out. I know we can do little additional advertising and promotion with the present discount rates."

R. E. Estel, Perryville, Mo.—"Because

of the lack of education not only in the value of the tractor, but in the enlightenment regarding its operation, two farmers were fatally injured while using tractors near Perryville in the last year. This resulted in the almost immediate abatement of the sale of motor tractors for a long while. We need education of all types and need it badly."

J. D. Manley, traveling representative of the Weber Implement Co., St. Louis, Mo.—"All dealers I visit complain that additional advertising is necessary, and are demanding it with increasing vigor."

P. A. Benham, Benham Hardware Co., Bonne Terre, Mo.—"In southeast Missouri there are very few tractors. While I haven't handled them for a great period of time, I am already feeling the results of the absence of convincing propaganda which should be distributed among the soil cultivating communities. Many farmers are afraid and seldom are they able to explain the foundation for their fears. My creed is teach the farmer."

Philip Schubert, Monk Implement Co., Belleville, Ill.—"Much of the service which we are required to give farmers using motor tractors would be avoided if the farmer were better acquainted with the parts of his machine. When the farmer buys a tractor it is because he has been made to believe that he will benefit. This is accomplished with great odds in the face of the dealer. Then following the purchase the farmer will not interest himself enough to learn the operation of the various parts of the engine and appendages. He expects the dealers to know all this and five years later may call upon the dealer to supply service which could have been side-tracked by a better knowledge. I think the manufacturer is to blame because he does not teach the farmer. It seems to be the object to sell and then forget about the sale. We need more co-operation."

V. E. Canepa, Canepa Implement Co., Festus, Mo.—"During the last two years we have sold 13 tractors to farmers near Festus. I dare say that this could have been doubled with more direct co-operation from the manufacturing distributors. However, there are some men with less than forty acres under cultivation who are running motor tractors."

Thomas David, Tebbetts, Mo.—"Five years ago there were no tractors in Calloway County. Today there are more than 280. I think this is due to the fact that extensive educational features have been introduced in our region. But additional effort could easily double the number that are working at present."

Edward G. Busch, Busch Implement

Co., Washington, Mo.—"The hilly ground near Washington has made many farmers believe that the tractor was impracticable. I find that I cannot convince them otherwise. The ground where it is rolling can be leveled and then given application with the plow. But they do not realize this. They must be taught."

Franklin Valbert, Valbert Implement Dealer, Flora, Ill.—"Flora has a great field for the sale of motor tractors, but the farmer does not know what he is buying and is unwilling to make what seems to him to be a dangerous investment."

Resolutions authorizing the incorporation of the association under the laws of Missouri were a closing feature of the convention. The annual election of officers resulted as follows:

Henry F. Woerther, Ballwin, Mo., president; **Frederick P. Watson, Mount Vernon, Ill.,** chairman of the board of directors; **Frank E. Goodwin, Kirkwood, Mo.,** secretary-treasurer. Vice-presidents named were: **Arkansas, Hamp Williams, Hot Springs; Alabama, S. E. Stewart, Hartsville; Illinois, E. A. Kahl, Shipman; Louisiana, Max Thieme, Winfield; Georgia, B. C. Reid, Reidsville; Mississippi, G. A. Wade, Greenwood; Missouri, T. N. Whitton, Trenton; Oklahoma, B. E. DeHart, Wilburton; Tennessee, W. H. Edenton, Jackson.**

The directors named for one year are: **L. C. Glover, Jonesboro, Ark.,** and **George Schneider, St. Peters, Mo.** Those for two years: **J. E. Seaman, Greenville, Ill.,** and **Oscar Grannemann, New Haven, Mo.**

Forty-four farm implement producing firms were hosts to the visitors during the three days of the convention. Sixty-five new members were added during the convention.

New Parenti Car to be Shown in Buffalo

BUFFALO, N. Y., Jan. 28—The new Parenti passenger car, made by the Parenti Motors Corp., this city, will be placed on exhibition at the Buffalo passenger car show in March. This car will be featured by its light weight and will be equipped with a 3 by 4½-in. Cameron air-cooled engine. The price of the car is \$1,685. The company is planning a production of 5000 cars for 1920.

Cameron Motors to Make Engines Only

NEW YORK, Jan. 28—The Cameron Motors Corp., which originally planned to build its own passenger cars and trucks, has decided to specialize on its six-cylinder air-cooled engines. These will be built for the passenger car, truck, tractor and airplane field. The interest which has been shown lately by the automotive field in general in regard to the Cameron engine was largely instrumental in the change of plans. Production of 25,000 3 by 4½-in. engines is now in full sway at its Shelton, Conn., plant. It is expected by June 1 the company will be producing daily ninety engines of all sizes.

French Builders Take Many Car Contracts

PARIS, Jan. 8—(*Special Correspondence*)—Future activities of the Gnome & Rhone Co. are to be varied. This firm, which during the war was one of the biggest producers of airplane engines in France, has entered into co-operation with the Rolland-Pilain Co. to build its 18 hp. chassis. They also have the license for the construction in France of the Swiss origin, and will build the British A.B.C. motorcycles for a French company. Other activities of this concern will be the production of the "Auror" agricultural tractor for Neuerburg & Fournier; textile machines for an Alsatian company; Diesel engines will be built under license from the Fiat-Ansaldo Co. of Turin, Italy; hydraulic machinery will be built under Hele-Shaw patents, and there will be special departments for such marine machinery as pumps, compressors, steering gear, auxiliary engines, etc.

The Gnome company was established in 1905 with a capital of \$120,000, which was increased in 1912 to \$160,000. The company was first interested in the construction of engines for automobiles and boats. During the years 1907, 1908 and 1909, when the French automobile industry was in a low condition, no dividends were paid. The firm became really successful in 1910, after having brought out its rotary air-cooled aviation engine. In 1918 the factory, which is in the suburbs of Paris, had to be transferred to Tours and Lyons, under the threat of a German advance. This interfered with production, and the dividend for that year was lower than for the two previous ones. Since the armistice the works have been reorganized on a peace basis and automobile production is now well advanced.

Canadian Goodyear to Increase Capital

DETROIT, Jan. 23—The capitalization of the Goodyear Tire & Rubber Co., Ltd., of Canada, will be increased from \$3,000,000 to \$30,000,000 and the present preferred stock will be retired. Some idea of the vast increase in the company's business is shown by the reports of increase in earnings from \$91,070 to \$13,976,349 yearly.

EXHIBIT IN PORTO RICO

WASHINGTON Jan. 23—An exposition will be held at San Juan, Porto Rico, some time in June, chiefly for the purpose of calling the attention of the inhabitants of the island to such American industrial and agricultural machinery and products as will be of value in developing native agriculture and industries, according to announcement made in a recent commerce report. The exposition will be held under the auspices of the Porto Rico Development Co. The project has been indorsed by the insular

government and a commission of leading business men has arrived in Washington to seek the co-operation of the Government departments and of American manufacturers. Inquiries should be addressed to Hon. F. Cordova Davila, Resident Commissioner for Porto Rico, House Office Building, Washington, D. C.

Studebaker Corp. Seeks 4,000 More Employees

SOUTH BEND, IND., Jan. 24—Studebaker Corp. of America production department has made requisition on the employment department for 4,000 additional employees for all branches of the factory between now and May 1. This is in line with the company's plan to get into production with the new light six by May 1, all of that model to be built at this plant. The Citizens' Homes Co., a subsidiary corporation, has let the contract for 84,000 cu. yd. of grading on the 87-acre sub-division, where the company plans to build homes for its employees.

TRADE OPPORTUNITIES

WASHINGTON, Jan. 24—The Bureau of Foreign & Domestic Commerce, Department of Commerce, has received requests for automobiles or parts agencies of business from individuals and companies in foreign countries; these are listed below. For further information address the Bureau of Foreign and Domestic Commerce, and specify the Foreign Trade Opportunity number.

A commercial representative of firms in Brazil is in the United States and desires to secure an agency for the sale of automobiles. Reference. 31825.

A manufacturer's agent in Australia desires to secure an agency for the sale of automobile accessories. Reference. 31826.

An American firm having branches in Egypt and Greece desires to secure agencies for the sale in the Levant of automobile tires. Quotations should be given f.a.s. New York. References. 31814.

A firm of commercial agents in Spain desires to secure the agency for the sale of a good type of American automobile. Correspondence should be in Spanish. Reference. 31835.

A firm in Sweden doing an import business desires to secure an agency for the sale of inner tubes for bicycles. Reference. 31843.

An importing agency in Korea desires to receive catalogs in duplicate, together with terms of export, and all information, such as prices with and without bodies, particulars of construction and terms, for the sale of automobiles in Korea and Manchuria. 31854.

OPENS SALES OFFICE

DETROIT, Jan. 23—W. F. Slomer, general sales and service manager of the Fellows Gear Shaper Co., Springfield, Vt., has opened offices in the Book Building, from which point direct service to the trade will be rendered.

Shippers Must Help Solve Car Shortage

Hines Pledges Continuance of Unified Control Advantages and Asks Co-operation

NEW YORK, Jan. 23—A pledge to continue the advantages afforded by unified control to the end of Federal operation of the railroads, and an appeal to shippers for co-operation, are contained in a statement issued to-day by Walker D. Hines, Director General of Railroads.

"Indications are," the statement says, "that the demand for transportation during the remainder of January and February will be extraordinarily heavy for this season of the year, and I take this means, first, of giving assurance that the Railroad Administration proposes until the last day of Federal control to make every effort to meet the extraordinary demand as fully as possible and, second, of pointing out some of the limitations which are operative now and which will continue to be for some time to come upon the performance of full transportation service.

"For the week ending Jan. 3, 1920, the number of cars of revenue freight loaded show an increase of 162,228 cars over the same week of 1919 and an increase of 216,269 cars over the same week in 1918. There is promise of even greater increase as the winter progresses. The Railroad Administration has not at any time been, and of course is not now in position to obtain the additional new equipment which is needed. Such equipment is chargeable to capital account and of course therefore must be paid for by the railroad companies.

"The problem has been intensified by the falling off in loading per car from 1918, when under pressure of the war very heavy loading was secured. The loading per car fell from an average of 29.2 tons in the first 11 months of 1918 to 27.8 tons for the same period in 1919, or a decrease of 4.89 per cent, this representing a loss of more than 105,000 cars available for loading. This falling off has occurred in spite of continued efforts of the Railroad Administration, assisted by the co-operation of many shippers.

Nevertheless the Railroad Administration proposes to continue to utilize to the end of Federal operation all the advantages given by unified control; it wishes to give shippers this assurance and to ask their continued co-operation.

ASIA MINOR WANTS CARS

WASHINGTON, Jan. 23—A growing popularity of automobiles and motorcycles in Mesopotamia is reported by the consul from that district, who states that their introduction by the British army has developed a demand on the part of the civilian population. At the present time there are no automobile equipment shops, and this interferes with growing sales.

Canada Regulates Aircraft Operation

Requirements for Pilots, Machines and Airdromes Ready for Announcements

TORONTO, Jan. 23—Regulations to which all persons operating aircraft in Canada, whether for private or commercial purposes, will in future be required to conform, have been approved by the Governor General in Council and will shortly be distributed. They provide for the registration, by the Canada Air Board, of all aircraft, and the issuance of certificates to pilots, without which certificate no person may fly in Canada. These certificates are obtainable only after applicants have satisfied the board by certain stipulated tests that they are qualified to operate a machine, and have also passed a medical examination. In the case of pilots operating machines for commercial purposes, medical examinations must be passed every six months and in case of private fliers every twelve months.

An interesting feature of the regulations is that all registered aircraft are subject to the call of the State in time of war, and that all persons holding commercial pilots' certificates, become, during a war period, members of the Canadian Air Force. All air harbors are subject to the control of the military authorities during war time. Machines must bear certain markings, which are clearly indicated in the regulations, and aerodromes and seaplane stations are also marked. No passenger aircraft is permitted to carry any explosives, and mails shall not be carried without the written authority of the Postmaster-General.

A private pilot's certificate does not authorize the holder to fly for hire, or for any reward except a prize in a contest under the auspices of a recognized aeronautic association. He must, before taking up a passenger, have completed at least ten hours' solo flying, and must make at least five flights of certain stipulated heights and distances, before being counted eligible for a certificate.

Commercial pilots' certificates, it is provided, shall not be granted to persons under nineteen years of age, and only after satisfying technical, medical and flying tests. These include a cross-country or overseas flight of at least 175 miles, beginning and ending at the same point, and a night flight of 30 minutes at a height of at least 1500 feet above the ground.

The question of customs collections at the international boundary has been solved by a ruling to the effect that all aircraft flying across the line will be required to stop at one of the border stations for examination.

Foreign aircraft must not conduct a business of transporting passengers or freight between points within the boundaries of Canada, but may carry them from a point in the United States to a point in Canada.

The pamphlet, which is being printed

by the Air Board, and which will include all the regulations, contains the conventions relating to international air navigation which were agreed upon, subject to certain reservations, by the International Commission on Aerial Navigation which was constituted as a sub-commission of the Peace Conference.

Oakland Plans 100,000 Production in 1920

PONTIAC, MICH., Jan. 24—An output of 100,000 cars in the fiscal year beginning July 1 is the schedule mapped out by Oakland Motor Car Co. officials. The figure equals the total production of the factory during the last four years. New buildings under construction on a \$3,000,000 expenditure program will make the schedule possible, officials say.

Goodyear Institutes Employee Thrift Plan

AKRON, OHIO, Jan. 24—Goodyear Tire & Rubber Co. this week put into operation its thrift plan for employees, which, in the opinion of financiers, marks an era in banking methods. The plan permits employees wishing to open savings accounts to instruct the company to withhold the weekly or monthly deposits, the company depositing the amount to the credit of the employee in the bank he designates. The company deposits the total sum in the various banks with accompanying voucher showing the names to which various amounts are to be credited. Hundreds of men and women employees already are taking advantage of the plan, which offers many inducements, notably elimination of the trouble of going to the bank and waiting in line for an opportunity to make a deposit.

ADDS USED TRUCK DEPT.

DETROIT, Jan. 23—Frank M. Foster, distributor of the Commerce, Hall and Winther trucks, has opened another establishment on East Jefferson Avenue for the sale of used trucks. All trucks turned in by customers, who desire a different size or type, will be overhauled at the service station in connection with the new store and will be in perfect running condition when placed on sale in the used store showroom. Foster has just completed the installation of what is said to be the largest tire press in the state, 350 tons, for use in pressing solid tires on truck wheels. It was installed in the shop of the Frank M. Foster Tire Co. on East Jefferson Avenue.

BAR GLARING LENSES

CHARLESTON, W. VA., Jan. 26—Enforcement of the law requiring non-glaring lenses on automobile headlights will begin immediately in West Virginia. Julius K. Monroe, member of the state road commission, said the clear lenses must be substituted by corrugated or frosted lenses. The law has not been enforced up to this time owing to the shortage of specified lenses.

N. Y. U. to Give Course in Highway Transport

NEW YORK, Jan. 23—A course in motor transportation engineering is to be added to the curriculum of New York University, to begin in February, according to an announcement made by Dean Charles H. Snow, of the School of Applied Science.

The new study, which is considered a clear indication of the ascending importance of motor truck transportation, is to be given by F. Van Z. Lane, chief transportation engineer of the Packard Motor Car Co., Detroit. It will form a part of the new course in industrial engineering and will be open to students in mechanical and civil engineering, particularly those specializing in subjects relating to highway engineering.

This course is the first of its kind to be given by any university in connection with industrial study, and will include the following lectures: The Future of the Motor Truck, Motor Truck Operating Costs, Motor Truck versus Horses, Motor Trucks versus Railroads, Trailers and Semi-Trailers, Special Bodies, Loading and Unloading Devices, Scheduling, Routing and Dispatching, Maintenance and Garaging, Hiring, Training, and Retaining Drivers.

Postal Motor Trucks Operate at Profit

WASHINGTON, Jan. 23—That motor trucks carrying food products for the Postoffice Department are profitable was indicated in a Congressional debate held recently, when the appropriations for motor trucks and air mail service were both eliminated from the Postoffice appropriation bill by the House of Representatives. It was shown by Congressman Kelly of Pennsylvania that five motor trucks operated from July 1 to Dec. 30, 1919, a period of three months, at a cost of \$14,588.14, including all expenses, and during the same period the postal receipts were \$52,067.41, making a profit of \$37,479.27.

That the use of motor trucks to haul the potatoes needed in the city of Washington would save over \$1,000,000 in one year to the consumer was pointed out by Kelly, who also stated that similar savings could be effected on eggs, butter and other farm products. For example, he stated this city requires 6,800,000 dozens of eggs a year, which could be brought by motor truck for 2 cents per dozen as compared with 19 cents per dozen under existing conditions, a saving of \$1,140,000 in 12 months under the motor truck plan.

TUNIS TARIFFS LOWERED

WASHINGTON, Jan. 23—The import duty on automobiles weighing up to 5511 lbs. and shipped to Tunis has been reduced from 70 per cent ad valorem to 45 per cent ad valorem. No change has taken place in the tariffs applying to automobiles of greater weight.

Cars and Trucks in Demand in Siberia

WASHINGTON, Jan. 22.—American automobiles and trucks are preferred in Vladivostok, especially the medium-priced ones, according to a report from Consul MacGowan to the Bureau of Foreign and Domestic Commerce. While at present there is only a small demand for motor vehicles of any kind on the part of the business and resident public, the military demand seems to be limited only by the ability of the Russian authorities to secure foreign exchange. When normal living conditions are restored in Siberia there will be a very large field for motor vehicles and tractors, but until the exchange rate is regulated, this market will be unprofitable, except for orders of very responsible organizations or individuals, adequately secured.

Large numbers of motor trucks are operated throughout Siberia by the military authorities. Trucks are operated advantageously, owing to the steep grades which are burdensome for horses and the extremely high cost of provender.

There is an increasing use by the military authorities of motorcycles with side cars, which are well adapted to the streets and roads, and are economical in operation owing to the comparatively small amount of gasoline required.

Canada to Begin Five Year Highway Program

OTTAWA, Jan. 26.—Active arrangements are being made for the carrying out this year the good roads policy initiated by the Government in its legislation at the last regular session of Parliament. By the terms of it \$20,000,000 is appropriated to be spread over a period of five years. This represents 40 per cent of the outlay, the provinces being asked to contribute 60 per cent.

The expenditure will be made by the provinces on the basis of contract, but the plans must be up to a certain standard, according to the traffic to be handled, and must be approved by the federal authorities.

Ontario this year plans to build a road from Windsor to Quebec boundary by way of London, Toronto, Kingston and Brockville, while the Quebec plans include roads from Hull to Montreal, Montreal to Sherbrooke, Montreal to Levis, South Shore and Levis to Rivière du Loup.

Premier Plans 3,000 Cars as 1920 Output

INDIANAPOLIS, Jan. 24.—Premier production plans for 1920 contemplate 3000 cars, model 6D, with one chassis design and six body styles. Closed models will constitute about one-half of the production. Premier completed 925 cars during 1919, in addition to 600 army trucks and the parts for 400 more for the Government. Extensions that will greatly increase the capacity of the plant are

contemplated late in 1920, though plans for the expansion will not be announced for some months. Dr. L. S. Skelton, who has been giving much attention to the plant since he became its owner, will devote most of his time in future to this particular property with the idea of placing the Premier in the front rank of passenger cars.

Plan Acme Exhibits at European Fairs

CADILLAC, MICH., Jan. 24.—Acme trucks will be exhibited at the Lyons, Leipsic, Brussels and other European fairs under auspices of the All Trading Corp. of Chicago. Harry Ziw, All Trading representative in Germany, Russia and the Balkans, spent several days at the factory getting information on the manufacture of the Acme bodies and the assembling of trucks. He will leave Feb. 9 for Europe.

OLDS PATTERNS DESTROYED

PONTIAC, MICH., Jan. 24.—Many valuable patterns, property of the Oldsmobile Works, were destroyed in fire that threatened the big plant last week. The fire originated in the pattern room, which was burned with all its contents, the firemen being handicapped by frozen hydrants and low water pressure.

ORGANIZE VENEER CO.

CADILLAC, MICH., Jan. 24.—Organization of the Detroit Veneer & Panel Co. was perfected at a meeting this week at which Roy Thompson was made plant superintendent and Benjamin Thompson salesmanager at the Detroit retail agency.

Trademark Treaty Passed by Congress

Bill Establishes Bureau in Cuba for Protection in Latin America

WASHINGTON, Jan. 23.—A bill was passed to-day by the House of Representatives which will make effective the convention for the protection of trademarks negotiated between this country and the Latin American countries, and which provides for the establishment of a central trademark bureau at Havana, Cuba, to which American manufacturers may apply for trademark registrations.

Heretofore, it has been necessary for manufacturers to apply individually to each of the Latin American countries, making payment in each country, and meeting with all of the local requirements, etc. The convention allows for a single registration and a single payment of fee, thereby doing away with considerable confusion that existed in the past and insuring greater protection for trademarks.

The convention has been entered into by the United States, Argentina, Brazil, Chile, Colombia, Cuba, Dominican Republic and Ecuador, who have signed up, and will be effective also in Costa Rica, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Salvador, Uruguay and Venezuela. It provides for the establishment of another bureau in Rio de Janeiro, which will operate similarly.

The bill passed by the House differs slightly from the one passed by the Senate some time ago, due to slight changes and minor amendments.

Automotive Equipment Solves Flood Problem



An automobile may have limited action in flood times, but automobile material is liable to come in very handy. When W. F. Bradley, European representative of AUTOMOTIVE INDUSTRIES, found his house shut off from the outer world by a depth of six feet of water, he built a raft out of gasoline drums, air tubes and a wash tub. In the "ship" he kept his family supplied with food for two days

Finnish Trade Hurt by Exchange Rates

German Cars Find Favor Because of Handicaps to American Makers

WASHINGTON, Jan. 23—Unless the exchange to Finland is stabilized there will be no demand for American automobiles, according to Consul Buhrman, in his report to the Bureau of Foreign and Domestic Commerce. There are 950 passenger cars, 70 trucks and 50 motorcycles privately operated in Finland and more will be purchased when the present rate of exchange, which is about thirty Finnish marks to the dollar, is stabilized.

The demand until recently has been for heavy cars, but is now displaying a tendency toward light machines. Of the European makes demanded, the Opel, N. A. G. and Benz of Germany, Italian Fiat, Austrian Danler and English Rolls-Royce are the most popular. Several American makes gained in popularity last year. The general impression is that American cars are not so durable as European makes.

Finnish roads are not well adapted to automobiling, being narrow, crooked and as a rule of dirt. It is anticipated that there will be considerable improvement in their highways as soon as normal conditions are resumed. The narrowness of the roads makes a demand for cars of narrow tread, light weight and long wheel base. The German manufacturers, familiar with these conditions, are introducing such models.

A growing demand for trucks of 2-ton and 3-ton capacity, both in agricultural and industrial fields, is reported. The present sources of truck supplies are Germany and Sweden. American motorcycles are most popular in Finland.

Treaty with Salvador Ratified by Senate

WASHINGTON, Jan. 27—A commercial treaty with Salvador negotiated by the State Department, was ratified by the Senate yesterday. Under its terms, manufacturers or dealers in Salvador or this country may operate as commercial travelers, personally or through agents, within the jurisdiction of the other country, by securing a license which costs a single fee, and which will be valid throughout the entire territorial jurisdiction.

Commercial travelers may sell samples without obtaining special licenses as importers. Samples without commercial value will be admitted free of duty and all samples marked, stamped or defaced so that they cannot be put to other uses, will be regarded as without commercial value. Samples having commercial value will be provisionally admitted upon giving bond for the payment of lawful duties if they have not been withdrawn from the country within six months.

No license will be required from representatives of companies who are trav-

eling in order to study trade and its needs, even though they initiate commercial relations, or from salesmen operating through local agencies which have already paid a license fee.

Form Selling Co. for Standard Bearing Co.

NEW YORK, Jan. 26—In line with the increased activities of the Marlin-Rockwell industries, a new organization has been formed, to be known as the Standard Sales & Service Co., with headquarters in Philadelphia and New York. This is the outcome of a plan to improve and expand the service and distribution of S. R. B. bearings, Rudge-Whitworth wire wheels and other Marlin-Rockwell products. H. M. Owsley, formerly manager of the service sales department of the Standard Roller Bearing Co., is president of the new company, which has succeeded to the business of the various branch sales offices established by the Standard Roller Bearing Co.

Ford Co. Pays \$7,500,000 on \$50,000,000 Notes

DETROIT, Jan. 24—Ford Motor Co. on Jan 16 paid off \$7,500,000 of the \$50,000,000 notes due that day on an issue last July of \$75,000,000 in a revolving credit arrangement with Boston bankers. The remaining \$42,500,000, due Jan. 16, was renewed for 90 days at 6 per cent interest.

Hartford Bus System to Cover Entire City

HARTFORD, CONN., Jan. 26—With 5-cent fares, 1-cent transfers and continuous service from 5 a. m. to 11 p. m. daily on the streets of Hartford, the Hartford Motor Bus Transportation expects to pull down at least a large portion of the business that now goes to the trolley company, which charges 6 cents for a short ride and more in proportion for a longer ride. Public sentiment is against the trolley company and its new zone system.

A certificate of organization has been filed with the secretary of state by the Hartford Motor Bus Transportation, and it is to be capitalized at \$1,000,000. E. H. Newton, general manager of the Riverside Motor Co. of this city, is vice-president and general manager of the new concern. Aaron Pevsner of New York is president; William H. Lacey, of the Hartford branch of the Kelly-Springfield Tire Co., is secretary and transportation manager. The buses will accommodate at least 20 passengers.

GRANTS BRITISH RIGHTS

PITTSBURGH, Jan. 26—The Duff Jack Sales Co., Ltd., located in the Oxford Circus House, 245 Oxford Street, London, W. 1, England, has been formed to represent the Duff Manufacturing Co. of Pittsburgh in the British Isles, and has been given the exclusive agency in this territory for Duff and Barrett jacks.

Formulate Plans for War Plane Operation

WASHINGTON, Jan. 26—Complete plans for the operation of aircraft in event of war have been formulated by the Secretary of War, Secretary of the Navy and the Aeronautical Board. Under the system arranged there will virtually be a department aeronautics for war, as the Aeronautical Board, comprising naval and military officers, is to have control of estimates of appropriations for both the navy and army, will co-ordinate training, information and research so far as possible, and pass on all plans of new projects for the construction of aircraft, experimental, stations and all stations to be used jointly by the army and navy.

Aircraft used in war will be designated in three classes as army, navy and marine aircraft. Army aircraft are those provided by the War Department and manned by army personnel. Navy aircraft are those provided by the Navy Department and manned by Marine Corps personnel. Marine air service is a part branch of the naval air service.

To Spend \$60,000,000 on Ontario Highways

OTTAWA, Jan. 23—That sixty millions of dollars will be spent on the improvement of Ontario's highways during the next five years was the statement of the Hon. F. C. Biggs, minister of Public Works and Highways, in the course of an address to a joint meeting of the Ottawa Board of Trade and the Ottawa Motor Club. He further stated that the long-sought Ottawa-Prescott Highway would be constructed this year and that the cost would exceed the estimated \$900,000. The road will link up with the trans-provincial highway at Prescott and (by ferry) with the New York State roads at Ogdensburg, thus providing a good road to the capital of the Dominion from all populous centers in the States and Canada from Sault Ste. Marie to the Atlantic seaboard.

OPENS EQUIPMENT HOUSE

NASHVILLE, TENN., Jan. 23—The Phillips-Chapman Co. has opened at 164 Third Avenue, North, as wholesale dealers in automobiles and equipment. Dan W. Phillips, for 14 years traveler for Belknap of Louisville and Simmons of St. Louis, is general manager. M. C. Chapman, formerly with the Indian Refining Co., will represent the house in the south and east of Nashville. G. A. Maxwell of Cookeville, Tenn., is also with the firm.

FORD GETS DAM RIGHTS

DETROIT, Jan. 24—Stockholders of the American Bell & Foundry Co., at Northville, Mich., at their annual meeting last week voted to sell the power dam rights to the Henry Ford Co. for \$6,000. Announcement that Ford was seeking to purchase the Northville power rights was made some time ago in connection with his announced plan eventually to manufacture every part of the Ford car.

China Plans Military and Trade Aviation

WASHINGTON, Jan. 23—China is preparing to greatly enlarge and develop both military and commercial aviation, according to reports received here. The Ministries of War and Communications have completed plans for the establishment of an efficient air service for the Republic of China and information indicates that President Hsu Shih-Chang is promoting the construction of a modern air service between Peking, Tientsin, Shanghai, Hongkong and Canton. The Minister of War is enlarging the Chinese aviation school at Nan-yuan, where aviation instruction is given for both military and civil purposes.

The order for airplanes given by the Chinese Government to Vickers, Ltd., England, was recently announced as being for the Vickers-Vimy type of planes, 42 ft. long, 15 ft. high, and 67 ft. wide, carrying two Rolls Royce engines, with a total of 750 hp. Their maximum speed is 115 m.p.h. They carry two pilots and seat twelve passengers in the cabin, which is enclosed. The maximum weight of freight and mail combined will be 2600 lbs.

Canadian Aero Club 1920 Officers Elected

TORONTO, Jan. 23—The Aero Club of Canada held its annual meeting in the club's quarters at 34 Yonge Street and transacted considerable business in connection with the program for the year to promote aviation. An election of officers was held and the following members were placed in office: Col. W. J. Barker, V. C., honorary president; Col. A. K. Tyllie, president; Major B. S. Wemp, D. F. C., first vice-president; Major A. M. Shook, vice-president for Ontario; A. F. Penton, honorary secretary; Capt. E. A. McKay, honorary treasurer. The following directors were elected: Capt. A. J. Hember, Capt. J. W. C. Clark, Major M. M. Sisley, Lieut. J. K. Shook and Lieutenant Purvis.

For the first time the club's badge was issued. It is a silver button, enamelled to represent the red, white and blue circles which were the distinguishing mark of British planes at the front. On the blue outer circle the words "Aero Club of Canada" are printed and a small silver plane is laid over the face.

Helps Manufacturers in Uruguayan Trade

WASHINGTON, Jan. 23—The manufacturers of farm tractors who desire to sell their products in Uruguay, can do so directly through the Uruguayan Government departments which have been established for the protection and development of agriculture in that country. Advertising matter may be sent to the Government departments for distribution. The Government department through which tractors and other farm machinery can be sold, including perhaps

farm lighting systems, is Inspeccion Nacional de Ganaderia y Agricultura, Cerro 572, Montevideo.

Invite President to Good Roads Convention

WASHINGTON, Jan. 23—President Wilson, Vice-President Marshall and Secretaries Lane, Baker and Houston were personally invited to-day to attend the annual convention in Hot Springs National Park, Ark., April 12 to 18, of the United States Good Roads Association, the Bankhead Highway Association and the Albert Pike Highway Association.

Continental Motors Plans Trade Growth

MUSKEGON, MICH., Jan. 24—Continental Motors Corp. plans business increases of \$10,000,000 during 1920 with the additional building space and equipment in the new \$1,000,000 plant nearing completion. The statement was made by President B. J. Tobin at the annual meeting of stockholders when the year's report, showing net profits of \$3,425,725.10 before deduction of \$1,153,637.09 for dividends and preferred stock premium, was submitted.

Missouri Registers 244,427 Cars in 1919

ST. LOUIS, Jan. 26—The number of motor vehicles in Missouri during 1919 was 244,427, as against 188,040 in 1918, a gain of 56,387, according to the report of the secretary of state. The gain since 1911, when the State had 16,287 motor vehicles, is 228,040.

During the war the number of licenses issued in St. Louis increased only 91 and in Kansas City only 136, while in the rest of the State the increase was 36,786.

Ontario Has 132,000 Cars

TORONTO, Jan. 23—Over 132,000 sets of motor vehicle licenses were issued in Ontario during 1919. The initial order for 1920 called for 150,000 sets of plates. These are being issued from 57 bureaus throughout the province. The issue will net the government over \$2,000,000. Revenue derived from motor vehicles is for highway improvement.

Indianapolis Show Set

INDIANAPOLIS, Jan. 26—The annual automobile show of the Indianapolis Automobile Trade Association will be held March 8 to 13, under the management of John B. Orman.

Lane Motors Retires

KALAMAZOO, MICH., Jan. 26—The Lane Motor Truck Co. has retired from business, the factory and equipment here being taken over by the Kalamazoo Motors corporation.

Prepare for Tests of Ford Street Car

Will Be Raced With Automobile
and Later on M. C.
Railroad

DETROIT, Jan. 26—The body for Henry Ford's gasoline street car, which was shipped to the tractor plant at Dearborn several days ago, has been fitted with the internal combustion engine, and plans for the test in a race with a fast passenger car are being completed. The car body is 37 ft. over all and will seat 42 passengers. The test car, which will be sent over the rails ahead of the Wolverine on the Michigan Central, will be a much heavier type than the proposed Ford street car, in order to conform to railroad transportation laws and conditions that will be confronted. It will be a double truck car, the weight of each truck with its four wheels exceeding 2000 pounds. The body was built by the G. C. Kuhlman Car Co. of Cleveland.

The power plant will weigh in the neighborhood of 1500 pounds, and the new street car will weigh in its entirety about 7 tons, in contrast with the 12 and 14-ton street cars now in use in all cities. The Ford car develops 90 hp. and will be able to make 70 miles an hour, though it is so constructed as to permit of its being geared to conform to city and state regulations. It is equipped with air and foot brakes and will take a 3 per cent grade at a speed of 20 miles.

The wastefulness of coal as fuel, according to General Manager Charles E. Sorensen, is just one of many reasons why the internal combustion engine and the individual power unit soon is destined to supersede present methods of steam as well as street railroads. He predicts its general adoption in the near future in view of the fact that it makes possible the use of lighter rail and does away with all the expensive paraphernalia of overhead transmission, transformers and costly power stations. Dangers of breaking electric wires are eliminated, and there is no possibility of complete tie-up, he says.

Sorensen has figured out that on the basis of 5 miles to a gallon of gasoline he could make the New York to San Francisco run without a stop for fuel. Neither Ford nor Sorensen will contend that the engine is perfect or that it will be available immediately for commercial purposes. They admit it may have to be torn to pieces and rebuilt, but both are confident of the correctness of their theory, and insist that the individual power unit and the liquid fuel engine is destined to take precedence over steam.

Tests of the car will be followed closely by railroad and traction companies in all parts of the country. Should it live up to expectations, it will probably result in a transformation of existing transportation methods.

Motor Age Editor Pneumonia Victim

**Darwin S. Hatch Succumbs—Was
Prominent in Automotive
Circles**

CHICAGO, Jan. 25—Darwin S. Hatch, managing editor of *Motor Age*, died of pneumonia at his home in this city after a brief illness of one week. Hatch contracted the disease after returning from the New York Automobile Show and, after spending two or three days in the office, was forced to give up his work. By this time pneumonia had partially developed.

Hatch had been associated with the editorial department of *Motor Age* from Oct. 1, 1909, at which time he entered the technical work as editorial writer and three years ago assumed the position of managing editor, which he held until his death.

During his ten years' service with *Motor Age* he was one of the active spirits of motoring in the Middle West. He served for many years as secretary of the Midwest Section of the Society of Automotive Engineers; during the past year he was secretary of the Chicago Automobile Club, and for practically ten years had been closely identified with the motoring contests of all character, generally handling the technical end of that work.

Hatch was an engineering graduate of the Purdue University and a native of Kentland, Ind., where his father, Jethro Hatch, was a practising physician for 45 years.

He is survived by his widow, Lillian Pendergrass Hatch, three children, Dorothy, Virginia and Darwin, Jr., and by his mother, Mrs. Jethro Hatch, Kentland, Ind.

Mr. Hatch was always a keen student of all motoring activities.

Uses of Aluminum Topic of Meeting

NEW YORK, Jan. 27—"The Uses of Aluminum" is to be the subject of discussion at a meeting of the Metropolitan Section of the Society of Automotive Engineers which is to be held in the Engineers Building, Feb. 10. The meeting will be attended also by members of the New York section of the American Society of Mechanical Engineers and the American Institute of Mining Engineers.

Indianapolis Races to Be Held May 31

INDIANAPOLIS, Jan. 26—The Speedway management has announced that the great International Sweepstake 500-mile race will be run this year on May 31, with tickets to be placed on sale Feb. 2. In this connection the Indianapolis Automobile Trade Association has announced that it will make reservations for any

trade association desiring to send representatives.

Among the latest entrants to the race is the William Small Co., of Indianapolis, which will enter three Monroe cars. The Monroe team is led by Louis Chevrolet.



DARWIN S. HATCH
Editor *Motor Age*

Hanson to Increase Stock to \$5,000,000

ATLANTA, GA., Jan. 29—More than 400 stockholders from all parts of the South attended the annual meeting of the Hanson Motor Co., makers of the Hanson Six, in Atlanta yesterday, when an eight per cent dividend on the common stock was declared and a six per cent dividend on the preferred stock. A resolution was presented and adopted by the stockholders authorizing an increase in the capital stock to \$5,000,000.

The same officers and directors were re-elected for the current year. They are: George W. Hanson, president; Victory R. Smith, vice-president; Charles W. Tway, vice-president; Arthur C. Burdett, secretary and treasurer; C. H. Arnold, Jr., M. W. Reid, C. D. Knight, A. P. Phillips, E. E. Pomeroy, George W. Little, Lowry Arnold and Dr. N. Z. Anderson, comprise the board of directors.

CONVENTION POSTPONED

NEW YORK, Jan. 24—The convention of the Material Handling Machinery Manufacturers' Association, which was to have been held at the Waldorf-Astoria, Jan. 29-30, has been postponed to Feb. 26-27.

Details of the program are being completed, and arrangements have been made to hold a morning business session on Friday, Feb. 26, which will be followed by a formal luncheon at the Waldorf with prominent speakers, and the afternoon session of the 26th will be devoted to papers and discussions on mechanical handling problems, a number of papers to be illustrated by moving pictures.

No Transport Tax on Export Shipments

WASHINGTON, Jan. 26—Transportation charges for property shipped for export and actually exported are exempt from taxation, under a ruling of the Internal Revenue Department, when the movement for export is continuous. In case there is a break in the movement of the commodity the tax becomes due. Exporters are required to keep files of proof of the export character of their shipments.

All shipments against particular contracts or orders for export, whether to Canada or Mexico or to Atlantic or Pacific coast points, which are not made through bills of lading in the case of Canada or Mexico or through export bills of lading in the case of rail and ocean shipments, must be covered by temporary exemption certificates and proof of the exportation of the shipments must be made by filing certificates of exportation.

Fair Price Committee Probes Gas Profiteers

ATLANTA, GA., Jan. 26—John A. Mangett, federal fair price commissioner for Georgia, has started an investigation of gasoline prices in Atlanta, following complaints against some of the local filling stations in which they are charged with profiteering. A committee has been appointed by Mangett to thoroughly investigate this matter.

Heretofore the federal price commissioner has confined his activities almost entirely to grocers and druggists, but lately he has broadened the scope of his activities, taking in almost any line of business against which consumers make complaints alleging profiteering. Some of the local dealers, it is charged, are selling gasoline to autoists at exorbitant prices.

Wilson Rubber Co. to Make Patent Patch

DES MOINES, Jan. 26—Work has been started on the first unit of the Wilson Rubber Co. plant here. The initial output of the factory will be limited to tire patches on which orders have been already received. The output of the tire patch department will be handled through Mitchel-Morris Sales Co., of Des Moines. J. B. Beuchlerh, inventor of the patch, is in charge of the department.

KEYSTONE SALES INCREASE

NEW YORK, Jan. 27—Gross sales of the Keystone Tire & Rubber Co. in 1919 were \$9,806,000, compared with \$6,172,000 in 1918.

NAMED IOWA DISTRIBUTER

DES MOINES, Jan. 26—The Elkington Lister Co. has secured the contract to distribute Rainier trucks in 29 counties in central Iowa.

Employee List and Wages Fall in Dec.

Slight Relaxation in Labor Situation Shown in Reports for Month

WASHINGTON, Jan. 24—Wages reported by thirty-nine automobile makers to the Department of Labor show an increase of 44.9 per cent for December, 1919, as against December, 1918, while during the same period the numbers of employees increased but 26.9 per cent. The thirty-nine manufacturers employed 101,729 workers for \$2,723,904 in December, 1918, as against 129,075 workers for \$3,946,728 in December, 1919.

Wages for December, 1919, have decreased as compared with those of November, 1919, in greater proportion than the numbers employed were lessened. Forty-four makers report 130,351 workers, with wages of \$3,975,884 for December, as compared with 133,704 employees with a payroll of \$4,207,402 for November, 1919. This shows a decrease of 5.5 per cent in the payroll for December, as compared with November, and a decrease of but 2.5 per cent in the numbers employed during the same period.

Studebaker Sales

\$80,000,000 in 1919

SOUTH BEND, IND., Jan. 27—The Studebaker Corp. enjoyed in 1919 its most successful year, total sales being approximated at \$80,000,000 for the 38,380 cars sold, net profits on this business probably to exceed \$10,000,000 net. Final surplus after all dividends will approximate \$7,150,000.

After deduction of preferred dividends the balance available for the \$45,000,000 common stock now outstanding will be more than \$20 a share. For 1918 net profits were \$3,884,195, or \$10.38 on the common stock.

Estimates by President Erskine for 1920 set the production at 80,000 cars with net sales running close to \$150,000,000.

Limit Targa Florio

Race to Stock Cars

PARIS, Jan. 17.—(Special correspondence.)—Stock cars only will be admitted in the next Targa Florio race to be held on the Island of Sicily, June 20. As a proof that the machine is a regular production job, it will be exacted that 100 have been delivered or are in course of construction on the day of the race. While no radical change will be permitted, it will be allowed to change the rake of steering gears, to fit a special gasoline tank, wheels and shock absorbers. In the engine the camshaft, the pistons and the compression can be altered, but the same material must be used for the competition cars as for the stock models.

The race will probably be for three laps of the course used last year, the distance being 268 miles. Although the road surface will be improved, it is not expected that it will be first-class, and naturally the gradients and innumerable turns will not be modified. The course is admitted to be one of the most difficult in Europe. There probably will be six classes, according to cylindrical capacity, the smallest being 91 cubic inches; from this the classes will rise by stages of 30 cubic inches.

It is understood that a full team of Citroen cars will be entered for this race. This will be the first time these cars have been seen in any public competition. Arrangements have been made to charter a steamer specially to carry the competing cars from Marseilles to Palermo, Sicily. The steamer will call at Genoa to pick up the Italian competitors. There will be a special train with sleepers which will run from Paris to the grand stands erected on the course. The journey will occupy three days.

Trucks Not Trucks If Under 2,000 Lbs.

PHILADELPHIA, Jan. 27—The State Highway Department in a recent ruling has determined that all commercial motor vehicles with a chassis weight of less than 2000 lb. are to be registered in the passenger motor vehicle class. Over 2000 lb. they are placed in the commercial category.

In some localities police have interfered with operation of light motor trucks operating under this ruling, and contended they were not properly licensed. They were, despite their solid tires and their cargoes.

Belgian Tractors to Experiment With Oils

PARIS, Jan. 17.—(Special correspondence.)—A competition for agricultural tractors consuming Congo palm oil or heavy mineral oils will be held by the Belgian Ministry of Agriculture, in the neighborhood of Brussels, during the coming spring. The object of this competition is to encourage the use of palm oil or other vegetable oils produced in Belgian colonies on the Congo. The first prize for machines using these oils will be \$3,000, and the second prize \$2,000. The prizes for the use of heavy mineral oils are \$1,000 for the first and \$600 for the second.

CUSHION SPRINGS TO BUILD

JACKSON, MICH., Jan. 24—Two new factory buildings, adjoining the present plant, will be erected by the Cushion Springs Co., at a cost of \$10,000. Permits were granted this week and work will begin immediately.

British Molders' Strike Continues

Loss of Export Automobile Trade Seen Unless Speedy Settlement Occurs

LONDON, Jan. 9.—(Special Correspondence.)—The vote of iron molders on terminating the strike by acceptance of the masters' terms resulted in a majority of 7087 against that course. Out of a total poll of 26,439 members, the number in favor was 9631, and against 16,718. So decisive a vote suggests that this struggle is likely to be prolonged, despite the fact that already it has lasted more than four months, has caused the shutting down of scores of engineering works, and is costing \$35,000,000 a week in production loss.

At first it was thought that supplies of castings would be forthcoming from France and Belgium, and in fact they did begin to come through, but the other branches of the men's trade union refused to handle them while the strike was unsettled, so it has not been possible to continue this source of supply.

Meanwhile the situation is becoming desperate, and in the case of the motor trade, unless production begins early next month, this year's motor export trade seems likely to be sacrificed. If this happens it is freely recognized that the prospects of the British makers recovering the British overseas markets will have vanished to the advantage of the United States chiefly, and quite possibly Italy and Germany, for although the rate of exchange is so much against Germany, the motor trade Germans are seeing to it that their chassis are listed at the corresponding present value of the British currency.

The fact that a big motor output seems possible from Canada in the near future may help to save the overseas market for the British trade, but much will depend both on the start of the quantity output necessary and the status of the owners of these Canadian factories. Most of them are merely branches of United States companies, which means that little if any share of the profits will find their way to Great Britain or the British Exchequer. There seems but one hope of the situation here being eased, namely, the disappearance of most of the present government.

Trade disputes of recent date have occurred from such causes as mishandling of complaints, lack of tact by certain ministers and heads of state departments, useless and unintelligible verbiage in supposed terms of agreement and suggested bases of compromise, and the cumulative effect of these and other factors affecting the general issue. All the same there is no direct evidence of anarchism or, as it is called, "radicalism," though if there be much acute hardship as a result of the press impasse it must fare badly with the whole British economic and social fabric.

Seeks Light Car for British Trade

Former Willys Representative
Visits America to Make New
Selling Connection

NEW YORK, Jan. 27—Joseph A. Mackle, recently general manager of the Willys-Overland, Ltd., of London, arrived in this city on Monday to spend two months in the United States, during which time he expects to complete arrangements for his future activities in London.

Mackle resigned his connection with the Willys-Overland immediately after the consolidation of the Overland and Crossly interests in England. He then registered a new company to be known as the J. A. Mackle, Ltd., with a capital of \$100,000. This company has obtained an option on a small factory but has not as yet decided upon its future work.

In visiting America, Mackle is seeking an American car that will fit his ideas of the best sales prospect in England. At present there is nothing offered between the Ford, at \$250, and the Overland 4, at \$500. The spread in price between these cars is due to the fact that the Ford imports only about 25 per cent of the parts and thus saves the heavy duty and shipping charges, while the Overland 4 has been shipped complete to England. Mackle believes there is an excellent opening for a car between these two and that this price can be made possible by selecting the proper American car and manufacturing some parts in England.

SIAM IMPORTS GROW

WASHINGTON, Jan. 30—The market for motor vehicles in Siam is limited owing to cheap water transportation, according to a report received by the Department of Commerce. The importation of motor cars for the fiscal year ending March 31, 1919, totaled ten more than in the previous banner year 1916-17, or 170, of which the United States furnished

160, the United Kingdom four and six from other ports. During the four-year period ending March 31, 1919, there were imported 539 cars, of which 469 came from the United States, 53 from the United Kingdom and seventeen from elsewhere. In the motorcycle field American makes have not captured such a large portion of the trade, for of the total of 277 imported during the six years ending March 31, 1919, only forty-six were from the United States, while 184 were from the United Kingdom and forty-seven from all other countries.

France Lowers Subsidy on Imported Tractors

PARIS, Jan. 17 (*Special Correspondence*)—Government subventions offered to purchasers of agricultural tractors now give an advantage to machines of French construction. The purchaser of a French tractor, who undertakes to fulfill certain simple conditions, can obtain from the Government a subsidy equal to 25 per cent the purchase price if the machine is of French origin. If an imported article the subsidy is reduced to 10 per cent. In the past the subsidy was the same whatever the origin of the machine.

REPORT ON GLUE TESTS

WASHINGTON, Jan. 30—The National Advisory Committee for Aeronautics has issued a report on the result of experiments with glue used in airplanes, the experimental work being conducted by the United States Products Laboratory of the United States Forest Service.

FIRM CHANGES NAME

NEW YORK, Jan. 22—The name of the Standard Woven Fabric Co., Walpole, Mass., maker of Multibestos brake linings, has been changed to Multibestos Co.

Opposes Plan to Merge Army Corps

N. A. C. C. Gives Reasons Why
Motor Corps Should
Remain Entity

NEW YORK, Jan. 24—The proposal to absorb the Motor Transport Corps in a general plan to control all forms of transportation in the United States Army, to be known as the Consolidated Transportation Corps, is brought to the attention of the members of the National Automobile Chamber of Commerce, in a bulletin issued recently.

"There is a feeling in the motor truck committee and among the directors," says the bulletin, "that the Motor Transport Corps should continue its individuality instead of being made a part of the general transportation service of the army, as provided for in the plan for a consolidated transportation corps. It has been suggested that those members who feel that the Motor Transport Corps should continue in its present form, might wish to take the matter up with their own senators and representatives.

"Among the reasons advanced for the continuation of the corps as a separate union are the following:

"1. The Motor Transport Corps in its present form can be more efficiently operated in times of war and peace.

"2. Under the proposed form of consolidation, supply depots in times of war, could not function properly if overburdened with supply and repair parts in connection with transportation by marine transports, broad and narrow-gauged railways, motor transports and animal power transports.

"3. In design and production, the explosive engine is entirely different from any other form of motor power, and has very little in common with other forms of transportation, being considered wholly special to itself.

"4. It would be difficult to construct a single depot to handle all the repair-work which would result from a consolidated transportation corps.

"5. In the matter of repairs, it is stated that hand repairs, in the case of motor transportation, cannot be consolidated with other forms of repairs, it being done generally by individuals on the spot.

"6. Under inspection, the technique of the various modes of transportation is wholly different and requires different men.

"7. So far as training goes, the personnel proposing the motor transport corps is so radically different from that which makes up the other forms of transportation, it would not perform well if absorbed into a general transportation scheme."

COMPLETE RUBBER PLANT

YOUNGSTOWN, O., Jan. 27—The Akron Maderite Rubber Co., recently organized, will begin production about Feb. 15, when its new plant at Newton Falls will be completed.

Government Has 15,939 Cars in Storage Available for Issue

WASHINGTON, Jan. 27—Fifteen thousand nine hundred and thirty-nine motor vehicles are reported in storage available for issue by the Director of Purchase and Storage of the War Department. Of these, 15,331 are serviceable and 608 are unserviceable. The following table shows the status. All ambulances are of General Motor Co. manufacture. Other items include various types.

	Serviceable	Unserviceable	Total
Ambulances	34	0	34
Cars	436	119	555
Trucks	4,410	472	4,882
Bicycles	5,578	0	5,578
Motorcycles with side cars	209	7	216
Motorcycles, solos	553	0	553
Bodies, truck	2,822	0	2,822
Chassis	515	0	515
Side cars	774	10	784
Total	15,331	608	15,939

Headlight Law Must Define Brilliancy

Texas Statute Dismissed by Court Which Decides Glare Needs Analysis

AUSTIN, TEX., Jan. 27—The law recently passed in Texas making it unlawful to drive at night with glaring headlights, has been declared inoperative and unenforceable, because it failed to specify exactly at which point the glare constituted a menace.

The decision of the court in brief was: "The statute is so framed as to be obnoxious to rule which requires some degree of certainty in informing one accused of crime of the nature of the accusation against him to which he is entitled under the constitution. In the statute, glare and brilliancy denounced as criminal, are such as to seriously interfere with the sight or temporarily blind the vision of the driver.

"What degree of interference is serious is a matter not fixed by the legislature; the glare and brilliancy are not described by any standard that is certain, that may be known in advance by the citizen, nor is there by the legislature any rule fixed for deciding at what point they reached the prohibited degree of brilliancy.

"Whether the act be criminal or not is made to depend largely upon the peculiarities that may affect the vision of the driver of the approaching vehicle."

Grocery Stores Will Sell Tires on Coast

LOS ANGELES, Jan. 23—The grocery store as a distributing point for automobile tires is the most recent innovation in Los Angeles. The Rubber Products Co., through its Pacific Coast representative, has made arrangements with the Ralphs Grocery Co. to act as distributors for Stronghold & Barborton tires. The Ralphs company operates a chain of seven stores in Los Angeles. It is a financially strong concern and the initial order was for a larger number of tires than the customary dealer would be likely to require in a year.

Difficulty in listing dealers whose finances will bear investigation is the reason assigned by Steward Slosson, representing the Rubber Products Co., for the selection of the Ralphs Grocery Co. "It is not that we would not like to have our lines handled by exclusive tire dealers that we have made this arrangement," said Slosson. "But it is difficult to get exclusive dealers who have enough money to keep up a stock of tires. Nearly all of the dealers depend mostly on taking orders and getting them filled at the tire company branches in the city. They carry a few tires in stock, but these are more for display than actual sale."

An issue that arises in connection with the transaction is that the Ralphs Grocery Co., by not being dependent exclu-

sively upon tire sales for income and by buying in big quantities is put in position where it can retail tires at a price exclusive dealers could not. In other words, they pay the factory price for the tires and sell them at their own figures. The entire trade will watch developments in this connection with no little interest.

PLANES TO SPOT SEALS

WASHINGTON, Jan. 27—Airplanes will be used on the coast of Newfoundland and eastern Canada for the purpose of locating seal herds, according to a report received by the Bureau of Foreign and Domestic Commerce. The undertaking is thought to be feasible and it is predicted will prove profitable.

Wheel Cos. Merge in \$10,000,000 Corporation

DETROIT, Jan. 29—Announcement was made to-day of the formation of the Motor Wheel Corp. of Lansing, Mich., a \$10,000,000 concern, in which will be merged the Pruden Wheel Co., Auto Wheel Co., and Gier Pressed Steel Co., all of Lansing, and the Weis & Lese Mfg. Co., spoke manufacturer, with factories at Memphis, Tenn., and Jackson, Mich.

Harry E. Harper, president of the Pruden Wheel Co., is to head the new company; D. L. Porter, general manager of the Auto Wheel Co., is to be vice-president, and B. S. Gier, general manager of the Gier Pressed Steel Co., is secretary-treasurer. Details of the financing program will be completed at a stockholders' meeting next week.

Prices Scale Upward on Willys-Overland

NEW YORK, Jan. 26—Price increases ranging from \$100 to \$250 are announced by the Willys-Overland, Inc., Toledo. Following are the new prices:

	1920.	1919.
Willys Knight touring..	\$1,975	\$1,725
Willys Knight sedan or coupé	2,950	2,750
Overland Four, touring or roadster	945	845
Overland Four, sedan wire wheels	1,575	1,355

WILL SELL EQUIPMENT

WASHINGTON, Jan. 26—The Air Service will dispose of considerable material that it has on hand at its various stations in Buffalo, New York and other points. Among the materials for sale are pipe fittings, receiver tanks, portable sand blasts, lacing candles, belt lacers, pump governors, drill attachments, pump jacks, pulleys, blow pipes, air hammers, electric motors, airplane linen, balloon cloth, airplane cotton.

Prices on British Car Bodies Higher

Listings Show Prices Being Ignored That Deliveries May Be Speeded

LONDON, Jan. 9 (*Special Correspondence*)—Apropos of recent articles in AUTOMOTIVE INDUSTRIES on "Trend of Body Design," the following retail prices of British bodies, and rates of pay to the British body-building trade, may be of interest. It may be noted that prices are increasing, there being seemingly so much affluence in certain channels that price is of less moment than time of delivery.

Two seater, with top and windshield, tool locker at rear, \$550; with dickey seat, \$625; with all accessories, \$800; special designs with all items, \$1,000.

Open touring body, \$1,000; with extra finish and all fittings from \$1,125 to \$1,250.

Taxicab landaulette about \$1,000, and \$500 more with special finish, etc.

Single landaulette not under \$2,000; limousine or three-quarter landaulette, to the trade, \$2,125; ordinary retail price (to public) about \$2,500.

Side-light cabriolet about \$100 more than a three-quarter landaulette, and a double cabriolet about \$3,750.

Two-seater coupé not less than \$1,500; with side lights, \$2,000 to \$2,500 and upwards, according to elaboration of detail.

Full sized, enclosed-body with fixed top, single entrance, from \$2,750, and with two entrances from \$3,000.

Following costs show charges of the various traders mentioned for the different types of body, including cost of labor in cutting up the timber at the saw-mills, but not cost of mounting on chassis, nor metal workers' time:

Two-seater with dickey seat: Bodymaker, \$50; painter, \$57.50; trimmer, \$47.50.

Torpedo: Bodymaker, \$72.50; painter, \$72.50; trimmer, \$52.50.

Taxicab: Bodymaker, \$87.50; painter, \$65; trimmer, \$100.

Three-quarter Landaulette: Bodymaker, \$152.50; painter, \$95; trimmer, \$100.

Side-light coupé: Bodymaker, \$175; painter, \$95; trimmer, \$127.50.

Enclosed car, fixed top, single entrance: Bodymaker, \$200; painter, \$120; trimmer, \$75.

Enclosed car, fixed top, two entrance, partition behind the driving seat: Bodymaker, \$250; painter, \$125; trimmer, \$85.

Limousine: Bodymaker, \$200; painter, \$125; trimmer, \$75.

SPEEDOMETER SALES GROW

CHICAGO, Jan. 27—Stewart-Warner Speedometer Corp. sales in 1919 approximated \$12,000,000, an increase of about 25 per cent over the previous year.

Dorris Co. to Make Dorris and Astra

St. Louis Factories Will Produce
4,000 Cars and Trucks
in 1920

ST. LOUIS, Jan. 26—The recently organized Dorris Motors Corp. of Wilmington, Del., capitalized at \$3,000,000, has purchased the assets and good will of the Dorris Motor Car Co. of St. Louis and the Astra Motors Corp., which was formed a few months ago to manufacture the Astra car, according to an announcement to-day by B. R. Parrot, president of the Delaware company, and Webster Coburn, vice-president and general manager of the former Dorris plant.

The new organization will continue to manufacture the Dorris trucks and passenger cars, only that production will be augmented by the addition of a total of 200,000 sq. ft. of floor space which will be provided by the erection of new buildings in the vicinity of the present Dorris plant.

An additional factory will also be provided for the production of the Astra touring car, which will soon be announced on the passenger car market at the price of \$1,318. The proposed plans already submitted by a local engineering concern indicate that the Astra car will be built in a three-story building adjoining the Dorris property. The dimensions of this building will be 180x200 feet.

The present facilities of the Dorris Motor Car Co. consist of three modern factory buildings having a floor space of 130,000 sq. ft.

The present staff of 443 employees of the Dorris company will be increased to 1000 by July 1, according to present plans. The organization, it was stated, has concluded arrangements with the Associated Motors Corp. of New York, a large exporting concern, for the delivery within 18 months of 3000 Astra cars for export to Europe and South America. The recent prices of the Dorris passenger car range from \$3,430 to \$5,720. During 1919 the Dorris company produced 207 passenger cars and 118 trucks.

A. H. Mansfield is treasurer of the new corporation. A. J. Kessinger, vice-president of the Newson Valve Co., manufacturers of automobile tires in St. Louis, is vice-president. President Parrot has been identified with the Jackson Automobile Co., American Gear and Axle Co., Standard Electric Co., and the Buick Motor Co. in the capacity of designing and consulting engineer, producing manager, factory manager and sales manager.

"The deal has been pending for five months," Parrot said, "and it was only after careful and most rigid investigation that we were able to convince our associates of the advantages afforded by our locating here. We figured that by all odds an automobile or truck could be built much more cheaply in St. Louis than any other available place in the

East. This applies to the proximity of the coal fields and other raw materials. Take iron, for instance, coming from the Birmingham district would necessarily have to pass through St. Louis, anyway, on its journey East. The labor situation in St. Louis, we find, is of a more stable nature. In New York there is too great a percentage of the 'floating' type, which is detrimental to efficient production.

"Within 18 months we will have produced 4000 trucks and passenger cars for immediate delivery. The corporation will construct its own motors and will plan to control the supply of the greater portion of its supplies."

The Dorris Motor Car Co. was organized in 1905, and was the oldest manufacturing automobile corporation in Missouri. Its capitalization was \$825,000.

Spaces Assigned for Aeronautical Show

NEW YORK, Jan. 26—Twelve exhibitors contracted for the entire main floor space of the Second Annual Aeronautical Exposition, to be held in the Seventy-first Regiment Armory, New York, March 6-13, under the auspices of the Manufacturers' Aircraft Association.

One-half of the space in the accessories section has been taken, and applications are still being received, which indicate that this space also will be completely taken before the show opens.

The following exhibitors will occupy the main floor:

Curtiss Aeroplane & Motor Corporation;
General Motors Corp., Dayton-Wright Division;

Interallied Aircraft Corporation;
Thomas-Morse Aircraft Corporation;
Ordnance Engineering Corporation;
Aeromarine Plane & Motor Corporation;
Packard Motor Car Co.;
Goodyear Tire & Rubber Co.;
L-W-F Engineering Corporation;
Glenn L. Martin Co.;
Aircraft Engineering Corporation;
Wright Aeronautical Corporation.

CHARGE UNFAIR METHODS

WASHINGTON, Jan. 30—The Federal Trade Commission, has cited the Silve Co., South Bethlehem, Pa., manufacturers of spark plugs, and the Aircraft and Motor Products Co., New York City, sales and distributing agents of the Silve Co., plugs, in formal complaint alleging the use of unfair methods of competition in interstate commerce. The respondents have 40 days in which to file answer.

DEALERS TO MAKE TRACTORS

SIOUX CITY, IOWA, Jan. 26—H. A. Wetmore has disposed of his motor car business here to C. A. Patch and will soon open a factory for the manufacture of tractors. A factory building to cost about \$75,000 is planned which will have a capacity of five tractors a day. The Wetmore tractor has recently been shown at farm shows in Omaha and Wichita.

Hayes Expected to Head Wheel Merger

Imperial Wheel and Pioneer Pole
Mentioned in New
Combine

NEW YORK, Jan. 27—Although the New York banking interests behind the deal have refused thus far to confirm it, it is understood that the Hayes Wheel Co., Jackson, Mich.; the Imperial Wheel Co., Flint, Mich., and the Pioneer Pole & Shaft Co., Piqua, Ohio, are negotiating a merger.

The capitalization plans are said to contemplate a \$20,000,000 corporation, controlling the entire output of the three large wheel and rim manufacturers, and the infusion of new financing to enhance production.

The present combination is said to have been started immediately after the failure, a few months ago, of a similar movement then affecting the Hayes Wheel, Pruden, Auto Wheel, Pioneer Pole, and other interests.

The Hayes Wheel Co., at the present time, has a daily output of 5,000 sets of wheels and a yearly business of \$20,000,000. The Pioneer Pole & Shaft Co. is among the world's largest producers of rims and spokes, and the Imperial company is believed to now stand next to Hayes in wheel production.

It is understood that C. B. Hayes, of the Hayes Wheel Co., is to head the merger.

British Exports Show Increase in December

LONDON, Jan. 15. (*Special correspondence*)—The export of British automobiles in December was as follows: Vehicles 219, chassis 107, their united values being nearly \$943,000. The export value of tires and tubes was nearly \$1,200,000. The export of parts was valued at nearly \$515,000. The gross value of the exports was about five times more than for December, 1918.

The motorcycle export trade figure was nearly \$315,000; tires and tubes \$139,545; and of parts \$140,145, compared with \$110,230, \$75,500, and \$42,880, in the corresponding categories for 1918.

For the twelve months of 1919 the total value of the British motor exports of vehicles, chassis, tires and parts was \$25,120,000 as against \$18,290,000 in 1918. The year's export value of British motorcycles, tires and parts was \$5,790,700 and in 1918, \$3,363,250. For the foregoing calculations the pre-war rate of exchange has been used.

OPENS CLEVELAND OFFICE

NEW YORK, Jan. 26—The Kearney & Trecker Co., Milwaukee, manufacturers of Milwaukee milling machines, announces that it will occupy a new Cleveland office and showroom at 738 Superior Avenue, N. W., Feb. 1. C. J. Sturgeon will be in charge of sales.

Must File Income Reports by Mar. 15.

Employers Must List Employees Receiving Over \$1,000 in Specified Time

WASHINGTON, D. C., Jan. 29—The importance of complying with the provisions of the revenue law requiring employers, tenants and others to furnish information as to income payments totaling \$1,000 or over during the year 1919, was emphasized to-day by Commissioner Roper. This requirement will be strictly enforced, according to the commissioner. Firms, organizations and persons who neglect to report this information to the government will be subjected to penalties provided in the law.

The information returns must be filed by March 15 next. Business men and others who made payments which must be reported are urged to compile the figures now, so that each employee may know just how much he received in the form of wages, salary, commissions, bonuses, etc., and with the aid of that information determine his individual liability to file a return and pay income tax.

Every person, firm or organization which made payments to another person, partnership, personal service corporation, or fiduciary of salary, wages, bonuses, commissions, fees, rent interest or other fixed or determinable income during 1919 in the total amount of \$1,000 or more must render an information return. The information in each separate case is entered on Form 1099, and a summary of these forms is made on Form 1096, which serves as a letter of transmittal.

On or before March 15, 1920, the complete return (Forms 1099 and 1096) must be forwarded to the Commissioner of Internal Revenue at Washington, marked "Sorting Division."

General Motors Talk Boosts Austin Stock

LONDON, Jan. 15. (*Special correspondence*)—Reports in London that the General Motors Corp., of America, are treating for the acquisition of the Austin works in Northfield, Birmingham, have caused an increase in the market price of Austin shares to about \$40. At first it was thought the Ford interests were behind the negotiations, but subsequent developments reveal the General Motors to be the negotiating party.

The Austin company's capital is \$8,250,000 and its turnover for the thirteen months ended December 31, was \$46,384,000. The factory covers 38 acres of ground and about 16,000 hands are employed when working to capacity.

It is significant of many events in prospect that American interests threaten to dominate the British motor trade at least in all that concerns popular priced cars. Already Ford, Willys-Overland and now the Buick company,

are masters "in our house." In common with the rest of the British trade, Austin's has been slow in getting into production. It is reported \$17,500,000 are on the company's books awaiting fulfillment.

Some of the London press writers have written much of an invasion of American cars. It is more correct to point out that they should have noted rather an influx of American capital, brains and methods of organized output, to show the British how to get the most out of their men and factories.—*Englishman*.

Financial Notes

Harley-Davidson Motor Co., in a balance sheet dated Dec. 25, 1919, shows a profit and loss surplus of \$4,246,302 as compared with a similar surplus of \$4,214,408 in 1918.

Willys Corp. shows a net income for the four months ended Dec. 31, after provision for Federal taxes, of \$1,656,998.

Cleveland Automobile Co. stockholders have voted to increase the common stock of the company from 14,000 to 300,000 shares, no par value. The old stock will be exchanged on the basis of 1 share to 20 of the new. There will be no change in the 8 per cent cumulative preferred stock, which remains at \$1,400,000.

B. F. Goodrich directors, in placing the common stock on a 6 per cent basis, have declared an additional dividend of one-half of 1 per cent on the common, which, with the dividend of 1 per cent declared last October makes total 1½ per cent, payable Feb. 16 to stock of record Feb. 5. The second quarterly dividend of 1½ on common is payable May 15. A dividend of 3½ per cent was declared on preferred stock, 1¼ payable April 1 and 1¼ July 1.

Continental Motors Corp. for the year ended Oct. 31, 1919, shows net profits, after deductions of \$3,425,725, equal, after preferred dividends and deductions for premium on preferred stock retired, to 22 per cent on the \$14,539,250 outstanding common stock. During the year \$1,593,766 was expended on plants and the preferred stock reduced to \$2,757,500 by purchase and retirement. Bank loans of \$850,000 were paid freeing the company of all obligations of that kind.

National Tire & Rubber Co. stockholders have approved plans of the directors for a reorganization of the company. Under the new arrangement the company's capital will consist of \$1,000,000 in 7 per cent preferred stock and 75,000 shares of no par value.

OSHKOSH ADDS TO CAPITAL

OSHKOSH, WIS., Jan. 19—The Oshkosh Motor Truck Co., Oshkosh, Wis., which will erect a new factory, 60 x 310 ft., is increasing its capital stock from \$500,000 to \$1,500,000 to finance the new plant and equipment as well as the general expansion of the business.

Engineer Here to Study Production

Hopes to Install American Methods and Equipment in French Factories

NEW YORK, Jan. 29—John Lycett, one of the engineers of the Lorraine-Dietrich Co. of Paris, arrived here this week on the Mauretania.

Lycett, who is accompanied by Alphonse Moreau and Clement Rabu, heads of factory departments, has come to America to study production methods. He will visit the important automobile centers, and will be particularly interested in labor saving machinery and in industrial welfare and factory organization methods that are in effect in American factories.

One of the problems in attaining quantity production in France, according to Lycett, is the attitude of the workingman toward the system and machinery that must be adopted. He confessed he could not forecast what this attitude would be, but he added that it could not make a situation much worse than at present.

The Lorraine-Dietrich Co. during the war was one of the biggest producers of aviation engines. The factory did not build a single car during the whole of the war. These works are now under the technical control of Engineer Barbarou, who was head of the Delaunay-Belleville Co. from its foundation to 1913. Barbarou, who is looked upon as one of the cleverest engineers of France, has designed a low-priced light six, which embodies French refinement with American production methods. It is intended to put this car on the market in great quantities at a very low price. In addition to the Lorraine-Dietrich Co., Barbarou is also engineer of the Clement-Bayard Co. This firm is also interested in quantity production, and has two models ready, designed exclusively with a view to low cost of production. Lycett believes there is a big field for such a car in France and also for such a French car in the export field.

One of the greatest difficulties these quantity producers have to meet with is the automobile body situation. No French body builders are equipped for big production. All their bodies are built up by hand, and at the present time cost almost as much as a chassis. It is the intention of both Lorraine-Dietrich and Clement-Bayard to lay down American plant for the production of automobile bodies cheaply and in big quantities.

Lycett speaks English fluently and will be pleased to meet American engineers while in this country and exchange views with them. He is stopping while in New York at Hotel Richmond, 70 West Fortieth Street.

OPENS ENAMELING PLANT

DETROIT, Jan. 24—The Good Enameling Corp., capitalized at \$10,000, has begun operations at 120 East Woodbridge Street.

Equipment Co. Formed to Build Truck Cabs

DETROIT, Jan. 24—The Motor Vehicle Equipment Co., to specialize in the manufacture of cabs for motor trucks, has been incorporated, with a capital of \$600,000, of which 5000 shares will be common and 1000 preferred, of par value of \$100 each. The plant is at 41 Federal Avenue, Detroit, and is headed by Fred England, who has been connected with the England Mfg. Co., sold recently to the Fisher Body Corp. John W. Foster, treasurer, formerly was a designer of automobile bodies for the England company and Chris B. Madson, factory manager, has had wide experience in the body manufacturing field. Charles T. Parsons, president of the England Co., is a director. The company expects to be in full production by Feb. 15. More than \$300,000 of the common stock was subscribed for and paid in at the first stockholders' meeting.

Chase Tractor Branch Organized in Canada

MONTREAL, Jan. 28—Chase Tractors Corp., Ltd., has been formed with a capitalization of \$2,000,000, and has acquired the business throughout Canada of the Chase Motor Tractor Co. of Syracuse, N. Y.

The company has also secured a plant adjoining the Canadian National Exhibition grounds, in which it is planned to build all tractors for Canadian requirements and also for requirements in all parts of the British Empire.

The Montreal and Toronto group who are connected with the new company include R. J. Cluff, president; T. P. Birchall, vice-president; W. J. Cluff, vice-president; James Whelen, Senator Curry, R. M. Wolvin and J. W. Norcross.

START ANDES TIRE PLANT

TOLEDO, OHIO, Jan. 24—The Andes Tire & Rubber Co. broke ground to-day for its new plant on a 17-acre site at Starr Avenue and the Terminal Belt railroad. The first unit of the plant will be 80 by 300 ft., and will be three stories high, with a basement. The concern, which is headed by Frank O'Brien, expects to develop a fabric company for the manufacture of fabric for rubber tires.

SCHARTOW CO. RELOCATES

SOUTH MILWAUKEE, WIS., Jan. 26—The Schartow Mfg. Co., manufacturing automotive equipment, chains, harness and saddlery hardware, has sold its plant at Racine, Wis., and will move to South Milwaukee, Wis., where a 5½-acre site has been acquired. The first building, 100 x 300 ft., will be erected at once. Members of the Stowell Co., South Milwaukee, manufacturer of hardware specialties and light malleable castings, have become affiliated with the Schartow company. Officers are: President, R. A. Nourse; vice-president, F. E. Schartow; secretary-treasurer, C. P. Nourse.

Current News of Factories

*Notes of New Plants—
Old Ones Enlarged*

Maibohm Production for 1920 Sold Out

SANDUSKY, OHIO, Jan. 23—The Maibohm Motors Co. earned 16 per cent in 1919 before depreciation and taxes, according to the annual report just issued. The earnings totalled \$139,745, of which \$89,714 was charged off to cover depreciation and taxes. Sales in 1919 showed an increase of 247 per cent over sales in 1918.

The company is now in full operation in its new plant, and is on a production schedule of 25 Maibohm Sixes per day. Its 1920 production schedule totals 7,500 cars, all of which have been sold to the Maibohm dealer organization.

REORGANIZE NEWARK CO.

NEWARK, N. J., Jan. 29—A reorganization has been effected of the firm of Slocum, Avram & Slocum Laboratories, Inc., and additional capital to the extent of \$500,000 has been provided by the sale of preferred stock. This new capital is to be used for carrying on the business and for expansion.

Slocum, Avram & Slocum Laboratories, Inc., have taken over the manufacture of Flexite products, including universal joints, propeller shafts and flexible magnet couplings, as well as the sale of these products. This business was formerly conducted by F. R. Blair & Co., Inc. The Blair universal is of the fabric type and has been fully described in AUTOMOTIVE INDUSTRIES.

COMBINE AXLE COMPANIES

CHICAGO, Jan. 26.—The McCord Mfg. Co. has acquired the business of the Russell Motor Axle Co., of Detroit; McCord & Co., of Chicago, and the Racine Manufacturing Co., of Racine, Mich. Payment for the companies was made in stock, the Russell purchase price being \$575,000 of the preferred issue.

The McCord Mfg. Co. is offering to common and preferred stock holders about 21,000 no par value shares of common stock at \$42.50 a share, in the ratio of one share to every five shares held.

TRACTOR CO. TO EXPAND

GREENVILLE, Jan. 26.—The Franklin Tractor Co., which has its office and factory in this city, has started to sell \$300,000 common stock to finance additions to its factory and machinery. A branch office has been opened in Columbus with Harry D. Hanes as district manager. The company manufactures the Franklin Centipede tractor which is designed for general farm work as well as for road work.

Will Make Hurlburt Trucks at Harrisburg

HARRISBURG, PA., Jan. 27—All of the facilities of the Harrisburg plant of the Harrisburg Manufacturing & Boiler Co. are available for the manufacture of Hurlburt motor trucks, through the completion of negotiations, it is reported, of the Hurlburt Motors, Inc., New York, makers of heavy duty trucks, with the Harrisburg concern. During the war, the Harrisburg plant made gun carriages and railroad car mounts for the navy artillery, including the big fourteen-inch guns. The same plant has had considerable experience in actual truck-making and in tractor-building. It manufactured the Morton tractor for hauling artillery which was shipped to Russia during the early period of the war.

Superior Truck Co. Changes Sales Policy

ATLANTA, GA., Jan. 29—E. M. Wiltingham, president of the Superior Motor Truck Co. of Atlanta, manufacturers of Superior trucks, has announced that the retail sales establishment in this city will be discontinued and that the trucks will hereafter be sold direct from the factory. This includes only Atlanta and vicinity and the company's present policy will continue in other sections. A service station will also be maintained for Superior truck owners at the Atlanta factory.

A new retail sales department is created with the discontinuance of the distributing branch and John L. Grice, salesmanager for the company, will have charge of this department. He will be associated in this work with G. P. O'Keefe.

FORGE CO. TO BUILD

LANSING, MICH., Jan. 24—The Federal Drop Forge Co., recently organized with a capital of \$400,000, has let the contract for its new plant and announces the selection of A. B. Shuart, of Ottawa, Can., a former Lansing man, as manager. The main building will be a hammer shop, 60 by 120 ft., and a building, 60 by 140 ft., for the die trimming and inspection departments, will be included.

AETNA RUBBER CHARTERED

CLEVELAND, Jan. 26.—The Aetna Rubber Co. has been chartered with a capital of \$335,000 to manufacture rubber articles of all kinds. The incorporators are George R. McKay, M. C. Teasdale, R. K. Pelton, W. A. Congalton and James Cosgriff.

OPENS MILWAUKEE OFFICE

INDIANAPOLIS, Jan. 26.—The Frederic S. Lawrie Co., sales agent of Indianapolis, has opened an office in Milwaukee. The company markets products of many large machine companies to the automotive trade.

New Officers Elected to Head Empire Rubber

NEW YORK, Jan. 26—Changes in the organization of the Empire Rubber & Tire Co., Trenton, N. J., were confirmed at a recent meeting of the board of directors. W. M. Pepper was elected president to take the place of J. E. Baum, who retired on account of ill health. F. I. Reynolds was elected vice-president. Reynolds was formerly tire sales manager of the United States Rubber Co. and now carries the title of the director of sales as well as vice-president.

C. Edward Murray, Jr., was elected vice-president and treasurer and H. R. Nason was elected secretary. J. Cornell Murray, former treasurer and director, resigned to become associated with the Crescent Insulated Wire & Cable Co. S. H. Smith, until recently factory manager of the Gillette Co., was appointed factory manager.

Fisher Made Manager of Buda Sales Forces

HARVEY, ILL., Jan. 26—The Buda Co. has announced the appointment of R. B. Fisher, as general sales manager, in charge of the domestic and foreign sales in the advertising department. Other changes announced are: John T. Mahoney, sales manager of the engine division, and S. Gordon, advertising manager.

These and other sales departments will be under the direction of Fisher.

CARTER JOINS NAPOLEON

TRAVERSE CITY, MICH., Jan. 24—H. C. Carter, for a number of years with the Dort Motor Car Co., later chief of the inspection department of the Republic Motor Truck Co., has been made factory manager for the Napoleon Motors Co. Carter is a man of broad experience in the automotive field and has devoted much of his time to trucks.

P. J. F. Batenburg, who for eight years was chief engineer and designer of the F W D Auto Co., Clintonville, Wis., on Jan. 1 became associated with the Mitchell Motors Co., Racine, Wis., as chief engineer. While the Mitchell company was engaged in producing F W D trucks for the army, Batenburg served as supervising engineer jointly for the government and the F W D Auto Co. He became associated with the F W D company when it was first organized and developed the present F W D truck.

S. Hodge Smith, superintendent of the Gillette Rubber Co. of Eau Claire, Wis., since the establishment of the plant, has resigned to become associated with the Empire Rubber Co. of Trenton, N. J., as works manager.

A. L. Kimball, formerly chief engineer of the Fulton Motor Truck Co., is now sales engineer for the Pierce Governor Co., Anderson, Ind., having charge of the territory east of Indiana.

Men of the Industry

*Changes in Personnel
and Position*

Murray Resigns as Bethlehem Motors Head

DETROIT, Jan. 24—Resignation of Arthur T. Murray, president of Bethlehem Motors Corp., was announced in a telegram received in Detroit yesterday, which also contained the information that Hiram F. Harris, former general manager of the Republic Motor Truck Co., would succeed him. Murray will devote his time to the American Bosch Magneto Corp., of which he also is president.

MARTIN JOINS STEEL CO.

NEW YORK, Jan. 26—A. H. Martin, formerly chief engineer of the Kissel Motor Car Co., has been elected secretary and general manager of the International Steel Products Co. of Hartford, Wis., manufacturers of automobile parts.

ELECT DART OFFICERS

WATERLOO, IOWA, Jan. 21—Officers elected at the annual meeting of the Dart Truck & Tractor Corp. are C. C. Wolf, president; W. H. Johnson, vice-president; M. D. Herron, vice-president, and E. L. Stover, secretary and treasurer. Directors elected are: C. C. Wolf, W. H. Johnson, M. D. Herron, E. L. Stover and S. Y. Eggert. Plans were made for plant extensions to take care of the company's increased business.

Fred J. Storm has been appointed assistant general manager of the Sewell Cushion Wheel Co. He has for years been closely allied with the motor truck industry.

L. Grant Hamilton, formerly advertising manager for the Regal Motor Car Co., who spent two years in war work in Europe, has joined the advertising department of the Federal Motor Truck Co.

H. E. Selig, head of the credit department of the Republic Motor Truck Co., Alma, Mich., has been promoted to assistant salesmanager. He is succeeded in the credit department by W. R. Tomlin, for years his assistant.

J. A. Holihan has resigned as salesmanager of the Muskegon Engine Co., Muskegon, Mich., the resignation to become effective in May.

Harry S. McClellan, former general superintendent for the Chalmers Motor Co., and for the last two years factory manager for the Buick Motor Car Co., at Flint, has joined the Dort Motor Car Co. organization, as director of manufacturing. Harry E. Rogers, former superintendent at the Buick plant under McClellan succeeds him as factory manager.

Export Investigator Gets New Position

NEW YORK, Jan. 27—The General Motors Export Co. announce the promotion of Frank E. Wodell, who for three years has been a trade investigator for the company in Australasia, to the position of assistant sales manager, in charge of all sales activities at the New York office.

In his stay in Australasia Wodell built up the General Motors dealer organization to a position of much strength. Frequent meetings are held by which the dealers keep in complete harmony in sales and service policies. Increasingly large sales for American manufacturers in his field are predicted by Wodell despite the handicap of money exchange rates and increased tariffs.

Sterling Rubber Co. Elects New President

RUTHERFORD, N. J., Jan. 23—A. A. Altschuler has been elected president of the Sterling Tire Corp., to succeed Spencer Welton, resigned. Altschuler has been a director of the corporation for several years and is also president of the International Fidelity Insurance Co. Succeeding Welton on the board of directors is Frank A. Ball, vice-president of the L. S. Starrett Mfg. Co. of Athol, Mass.

The Sterling plant now has a capacity of 1200 tires a day and additions are planned which will bring the capacity to 2000 daily.

NAME NEW OFFICIAL

NEW YORK, Jan. 26—A. H. Martin, formerly chief engineer of the Kissel Motor Car Co., has been elected secretary and general manager of the International Steel Products Co. of Hartford, Wis., manufacturers of automobile parts.

George O. Starr has been appointed sales and advertising manager of the Murray Motor Car Co., of Newark, N. J. He was formerly sales engineer with the Swan & Finch Co., New York.

George Allen, formerly assistant purchasing agent of the Buick Motor Car Co., has been promoted to purchasing agent, to succeed M. P. Cromling, who resigned to join the Willys organization.

M. F. Stapleton has been appointed western salesmanager of the radiator division of the Marlin-Rockwell Corp., New Haven, Conn. He will make his headquarters in the Kresge Building, Detroit.

G. C. Weyland, formerly general salesmanager of the J. I. Case Plow Works Co., Racine, Wis., has been elected vice-president in charge of sales, to succeed L. N. Burns, resigned.

Morrison J. Oswald and Charles J. McPherson will have charge of sales and production, respectively, of the Hopkins Mfg. Co., body builders of Hanover, Pa. Both men were formerly with J. G. Brill Co.

Calendar

SHOWS

- Jan. 31-Feb. 6—Kansas City, Mo. Annual Exhibition, Overland Bldg. E. A. Peak, Manager.
- Jan. 31-Feb. 7—Minneapolis, Minn. Twin City Automobile Truck, Tractor and Industrial Show, Overland Bldg.
- February—Chicago International Automobile Mfrs.' Congress.
- Feb. 2-7—Rochester, N. Y. Rochester Automobile Trades Assn., Exposition Park. Benjamin L. Peer, Manager.
- Feb. 2-7—Toledo, Ohio. Annual Automobile Show, Terminal Auditorium.
- Feb. 3-7—Wilmington, Del. Automobile Show, Hotel du Pont.
- Feb. 3-7—Baltimore, Md. Automobile Show, Baltimore Automobile Dealers Assn. Fifth Regiment Armory. John C. O'Brien, Manager.
- Feb. 4-7—Peoria, Ill. Passenger Car Show, Peoria Automobile Dealers and Accessory Assn., Coliseum.
- Feb. 9-10—Peoria, Ill. Truck Show, Peoria Automobile Dealers' and Accessory Assn., Coliseum.
- Feb. 9-13—Charlotte, N. C. Automobile Show, Charlotte Automobile Trade Assn. Lee Folger, Chairman, Show Committee.
- Feb. 9-14—Cedar Rapids, Ia. Annual Automobile Show, Linn County Motor Trades Bureau, Auditorium. W. J. Hutchings, Chairman, and H. M. Davis, Secretary.
- Feb. 9-14—Poughkeepsie, N. Y. Annual Automobile Show, Poughkeepsie Auto Club, Armory. George A. Coleman, Manager.
- Feb. 9-14—Salt Lake City. Annual Automobile Show, W. D. Rishel, Manager.
- Feb. 9-14—Nashville, Tenn. Nashville Automobile Trade Association.
- Feb. 10-13—Fargo, N. D. Barry Bldg. Fargo-Moorehead Automotive Trade Assn. H. L. Wilson, Director.
- Feb. 10-15—Quincy, Ill. Annual Automobile Show.
- Feb. 11-14—Mason City, Ia. Sixth Annual Automobile Show, Mason City Automobile Assn., Armory.
- Feb. 13-23—San Bernardino, Cal. Automobile Show, Tenth Annual National Orange Show, Milton Standish, Secretary.
- Feb. 14-21—New Castle, Pa. Annual Automobile Show, Lawrence County Automobile Trades Assn. J. B. Foster, Manager.
- Feb. 14-22—San Antonio, Tex. Automobile Show, San Antonio Automobile Trade Assn. W. A. Williamson, Manager.
- Feb. 16-21—Des Moines, Ia. Annual Automobile Show, Des Moines Automobile Dealers' Assn. Ford Factory, Dean Schooler and C. G. Van Vliet, Manager.
- Feb. 20—Cleveland, Cleveland Section S. A. E., Hotel Statler.
- Feb. 21-28—San Francisco. Fourth Annual Automobile Show, Exposition Auditorium, Motor Car Dealers' Assn. G. A. Wahlgreen, Manager.
- Feb. 21-28—Louisville, Ky. Twelfth Annual Exhibition, Louisville Automobile Dealers' Assn. First Regiment Armory.
- Feb. 23-27—Reading, Pa. Annual Automobile Show, Reading Automobile Trades Assn., Auditorium. N. S. Jorgenson, Manager.
- Feb. 23-28—Elmira, N. Y. Elmira State Armory, Elmira Automobile Club. H. S. Bryan, Manager.
- Feb. 23-28—Springfield, Ohio. Annual Automobile Show, Springfield Automobile Trades Assn., Memorial Hall. W. E. Stevens.
- Feb. 23-28—Portland, Ore. Truck Show, Armory, Dealers' Motor Car Assn. M. O. Wilkins, Manager.
- Feb. 23-28—Portland, Ore. Car Show, Hippodrome Building, Dealers' Motor Car Assn. M. C. Wilkins, Manager.
- Feb. 23-28—Grand Rapids, Mich. Motor Car Show, Furniture Exposition Building. M. D. Elgin, Manager.
- Feb. 23-28—Duluth, Minn. Automobile Show, Duluth Auto Trades Assn. W. F. Daly, Director.
- Feb. 28-March 6—York, Pa. Annual Automobile Show, York County Dealers' Assn., Overland-Harrisburg Garage. R. A. Anderson, Manager.
- Mar. 1-6—Springfield, Mass. Annual Automobile Show, Auditorium, Springfield Automotive Dealers' Assn. Robert H. Clark, Manager.
- Mar. 1-6—St. Joseph, Mo. Annual Automobile Show, St. Joseph Automobile Show Assn., Auditorium. John Albus, Manager.
- Mar. 1-6—Grand Rapids, Mich. Truck Show, Furniture Exposition Bldg. M. D. Elgin, Manager.
- Mar. 1-7—Springfield, Mass. Annual Automobile Show, Springfield Automobile Dealers' Assn. Harry Stacy, Secretary.
- Mar. 1-8—Seattle, State Armory, Motor Car Dealers' Assn. William J. Coyle, Manager.
- Mar. 2-6—Springfield, Ill. Annual Automobile Show, Springfield Auto Dealers' Assn. John Brodhead, Manager.
- March 3-6—Clinton, Ia. Annual Automobile Show, Clinton County Automobile Dealers' Assn., Coliseum. Harry G. Finch, Manager.
- March 6-13—New York, N. Y. Second Annual Aeronautical Exposition, Manufacturers' Aircraft Assn., Inc., 71st Regiment Armory. Walter Hempel, Manager.
- Mar. 6-13—Greenville, S. C. Carolina Automobile Show, Greenville Dealers' Assn. Textile Hall.
- Mar. 7-13—Muskegon, Mich. Automobile Show, Muskegon Auto Business Men's Assn. J. C. Fowler, Manager.
- Mar. 8-13—Indianapolis, Ind. Annual Automobile Show, Indianapolis Auto Trade Assn., Manufacturers' Bldg. State Fair Grounds. John B. Orman, Manager.
- Mar. 10-13—Lebanon, Pa. Annual Motor Show, Automotive Trade Association of Lebanon, James Furniture Store-Bldg. J. Paul Enck, Manager.
- Mar. 12-20—Boston, Mass. Annual Automobile Show, Mechanics' Building.
- Mar. 15-20—Great Falls, Mont. Automobile Show, Montana Automobile Distributors' Association.
- Mar. 20-27—Trenton, N. J. Annual Automobile Show, Armory, Trenton Automobile Dealers' Assn. John L. Brock, Manager.
- March 20-27—Pittsburgh. Motor Square Garden, Automotive Association, Inc. John J. Bell, Manager.
- Mar. 22-27—Oklahoma City, Okla. Annual Automobile Show, Oklahoma City Motor Car Dealers' Assn. G. W. Woods, Manager.
- Feb. 22-28—Ottawa, Ontario. Motor Show.
- Feb. 22-March 6—Birmingham, England, British Industries Fair.
- March—London, England. Motor Boat Marine and Stationary Engine Exhibition.
- March—Adelaide, Australia. All Australian Exhibition of motor vehicles, airplanes, engines and automotive equipment.
- March 1-15—Lyons, France. Automotive Products, Lyons Industrial Fair.
- April or May—London, England. Commercial Vehicle Exhibition, Olympia.
- April 3-May 4—Buenos Aires. Exposition of U. S. manufacturers.
- July—London, England. International Aircraft Exhibition, Olympia. The Society of British Aircraft Constructors.

TRACTOR SHOWS

- Feb. 2-14—Wichita, Kan. Tractor and Farm Machinery Forum, Wichita Thresher-Tractor Club.
- Feb. 16-21—Kansas City, Mo. Fifth Annual Kansas City Tractor Club. Guy S. Hall, Manager.

CONTESTS

- August, 1920—Paris, France. Grand Prix Race, Sporting Commission Automobile Club of France.
- June, 1920—Omaha, Neb. Reliability Truck Tour.

CONVENTIONS

- Feb. 9-13—Louisville, Ky. Seventeenth Annual Convention American Road Builders' Assn., Tenth American Good Roads Congress, and Eleventh National Good Roads Show.
- May 13-20, 1920—San Francisco. Seventh National Foreign Trade Convention.

S. A. E. MEETINGS

- Feb. 10—Metropolitan Section Meeting, Engineers' Bldg. New York, New York Section. American Society of Mechanical Engineers and American Institute of Mining Engineers. Subject: "The Uses of Aluminum."
- Feb. 12—Kansas City, Mo. Tractor Dinner, Hotel Baltimore.

FOREIGN SHOWS

- January—Glasgow, Scotland. Scottish Motor Exhibition.
- February—Manchester, England. North of England Motor Exhibition.

Form Plans for Three

International Roads

OTTAWA, ONT., Jan. 30—Three great international automobile roads, all of which will cement more closely the friendly relations between Canada and the United States, are being planned and much of the preliminary work has already been done by friendly co-operation on both sides of the international boundary.

One is the great "Road of Remembrance," from the Pines to the Palms, stretching from the far flung boundaries of northern Ontario to the Gulf of

Mexico at New Orleans. Another is the boulevard roadway leading from Winnipeg and points north through North Dakota and Minnesota through the Mississippi Valley, and the third will connect Alberta and Montana.

On the "Road of Remembrance" it is proposed that trees shall be planted, each to be dedicated to a fallen hero, and each, therefore, to perpetuate in growing beauty the memory of the brave men who fell in the great war. "Victory Oaks" have already been planted all along the road through Louisiana.

Considerable construction has already

been done on the road south from Winnipeg, for which large appropriations have been made on both sides of the line. Preliminary surveys have been made on the road linking the great national parks, and as soon as weather conditions permit, the actual work will be started.

PERRY PLANT OPENS

COLUMBUS, OHIO, Jan. 31—The D. N. Perry Co. has opened for business at 653-657 North Fourth Street, Columbus, for the manufacture of automobile tops, cutains, cushion covers and similar supplies.